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2 December 2016

Bryan Green MP
Leader of the Opposition
Parliament House
HOBART TAS 7000

Dear Sir

10 Year Asset Management Plan 2016 - Internal Review of Right to Information Request

I refer to my recent email exchanges and conversations with Mr Luckman, and to your letter of 21 October 2016 requesting an internal review of Hydro Tasmania's earlier response regarding the 10 Year Asset Management Plan 2016. I can advise I have reviewed the decision relating to the earlier request and re-assessed the material, taking into account the matters raised by you in your letter.

As to the first limb of the request to review - I am of the view that, subject to the following, the material provided was comprised of information being internal deliberate information for the purposes of Section 35(1) of the Act.

That said I do however take the view that there was some purely factual information which could have been provided pursuant to Section 35(2) of the Act.

Due to the extant editing restrictions of the original response I draw your attention to the highlighted (in yellow for your convenience) text in the attached document which I have un-redacted. Remaining text that was previously redacted is now blacked on these pages. Pages that remain unchanged from the original response are in the same form as first provided, i.e., the redacted material is simply not shown (rather than blacked-out).

As to the second limb, it is clear to me that the emphasis in your letter is centred on the aspect of "government" when taking into consideration the "public interest".

Interestingly, the term "government" is not defined in the RTI Act nor is it defined in the *Acts Interpretation Act 1931*. I have taken the meaning as not being a literal reference to the "Tasmanian Government" but a general reference to democratic government and public authorities generally and so applies here.

In considering this aspect of your request I addressed the matters in 1(a), (d) and (f) of Schedule 1 as a subset of the matters in the Schedule and then only in the context of the redacted parts of the initial report (the balance having been released). For completeness it is to be noted that I have also considered the remainder of Schedule 1 in coming to my conclusion.

It is my respectful opinion that on balance the application of the above subsections to the remaining redacted material provides no further clarity to the context of the Report or possible future decision making within the business, upon the matters canvassed in the Report, that is not already evident from the un-redacted materials, including, but not limited

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to, the Synopsis and Executive Summary. Accordingly no further information should be un-redacted, as being "in the public interest".

Yours sincerely

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10-Year Asset Management Plan 2016 Summary

ASSETS & INFRASTRUCTURE

July 2016

DOCUMENT CUSTODIAN: Assets & Infrastructure – Asset Strategy & Risk

ED NO.	DATE	REVISION DESCRIPTION	SIGNATORIES/APPROVAL(S)		
			AUTHOR(S)	Lead	APPROVAL
1st	15 October 2010	1st 10-YearAM Plan - Sweating the Assets	Generation		
2nd	21 March 2012	2nd 10-YearAM Plan - BSI Distribution added	Technical & Operations		
3rd	14 March 2013	3rd 10-Year AM Plan - Alternator + Turbine	Technical & Operations		
4th	February 2014	4th 10-Year AM Plan - Civil Assets + Maintenance	Technical & Operations		
5th	March 2015	5th 10-Year AM Plan - Summary Version	Assets & Infrastructure		
6th	April 2016	6th 10-Year AM Plan - Summary Version	Assets & Infrastructure		

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CONTENTS

1. **Synopsis** 1

2. **Executive Summary** 2
   - 2.1 Asset Portfolio Risk Summary 4

3. **Asset Management** 7
   - 3.1 Outcomes Targeted 7
   - 3.2 Value Proposition: Economic Efficiency and Effectiveness 9
     - 3.2.1 Effectiveness of the 10-Year Asset Management Plan 9
     - 3.2.2 Economic Efficiency 14

4. **The Asset Base** 18
   - 4.1 Hydro Power Generating Assets 18
   - 4.2 Bass Strait Islands (BSI) 21

5. **Business Risks** 23
   - 5.1 Rotating Plant Portfolio Risk Profile 24
   - 5.2 Electrical Asset Portfolio Risk Profile 25
   - 5.3 Dam Portfolio Risk Profile 26
   - 5.4 Civil Portfolio Risk Profile 27
   - 5.5 10-Year Asset Management Plan Execution Risks 28
     - 5.5.1 Specialist Skills and Facilities 28
     - 5.5.2 Knowledge Management and Systems 29
     - 5.5.3 Funding and Delivery Momentum 30

6. **Operational Risk Management Programmes** 32
   - 6.1 Dam Safety Programme 33
   - 6.2 Civil Asset Programme 33
   - 6.3 Mechanical and Electrical Asset Programmes 34
   - 6.4 Delivery Assurance Programme 34
   - 6.5 Statewide Maintenance Programme 35
   - 6.6 Bass Strait Islands 35
   - 6.7 Operational Compliance Programme 36
   - 6.8 Programme Management 36
   - 6.9 Sustainable Resource Management (SRM) Programme 36

7. **Capital Investment Programme** 38
     - 7.1.1 Turbines and Alternators 38
     - 7.1.2 Electrical Protection 39
     - 7.1.3 Mechanical Protection and Unit Control 40
     - 7.1.4 Governor and Excitation 40
     - 7.1.5 Dam Safety 40
     - 7.1.6 Civil Assets 41
     - 7.1.7 Bass Strait Islands 41
     - 7.1.8 Planned Investment by Asset and Station 41
   - 7.2 Capital Investment Governance 43

8. **Staff** 44

9. **Key Success Factors** 46

10. **Conclusion** 47

Hydro Tasmania
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FIGURES

Figure 1: A&I Business Strategy 7
Figure 2: Production Opportunity Performance Trends 9
Figure 3: Asset Risk Issues from FYE2007 to FYE2015 11
Figure 4: Comparison of Capex per Asset Base 12
Figure 5: Operations and Maintenance Cost Reduction Trend 13
Figure 6: Cost Savings of the Standardised Controls Programme 16
Figure 7: Cost Savings of the Standardised Governor Programme 17
Figure 8: Catchment and Hydro Power Stations 18
Figure 9: Production Age Profile 20
Figure 10: Hydropower Station Mid-Life Profile 20
Figure 11: Societal Risk Plot for major Dams with Life Safety Risk addressed in the 10-Year Plan 27
Figure 12 Water Conveyance Portfolio Causal Factor Distribution 28
Figure 13: Turbine & Alternator Capital Plan 39
Figure 14: Age Demographic of A&I Staff 44

TABLES

Table 1: Portfolio Risks - Most Important Considerations 4
Table 2: Cumulative Achievements of the 10-Yeaar Plan from 2010 to 2025 (excludes Civil & Dams) 11
Table 3: Overview of Asset Portfolio 19
Table 4: Bass Strait Islands Asset 21
Table 5: Electrical Protection Capital Plan 39
Table 6: Mechanical Protection & Unit Control Capital Plan 40
Table 7: Governor and Excitation Capital Plan 40
Table 8: Dam Safety Capital Plan 40
Table 9: Capital Plan for Civil Assets FYE2016 to FYE2025 41
Table 10: Bass Strait Islands Capital Plan 41
Table 11: 10-Year Capital Plan by KDCA 42
Table 12: 10-Year Capital Plan by Station 42

1. Synopsis

Hydro Tasmania's 10-Year Asset Management Plan (10-Year Plan) is a multi-use document that presents detailed plans to effectively manage the diverse portfolio of hydro generation assets in Tasmania and the generation and distribution assets on the Bass Strait Islands (BSI). The 10-Year Plan excludes the Tamar Valley Power Station which has its own stand-alone asset management plan.

The 10-Year Plan has the following specific uses:

- To provide a yearly update of asset management strategies and operational plans required to sustain generation capability and prudently manage portfolio risks;
- To consolidate and communicate both the detail and context of the annual capital and operational programmes and their associated resourcing requirements;
- To convey the business risks associated with the hydropower production portfolio and the generation and distribution activities on the BSI;
- To provide a reference document for staff involved in managing and operating the respective asset portfolios;
- To provide a reference document for the various asset management auditors, Regulatory Reporter[1] and independent reviewers who periodically assess the integrity of assets and the adequacy of the asset management plans and practices; and
- To serve as a communication tool for the broader business, contractors, suppliers and OEMs to understand the areas of focus, challenge and opportunity.

The 10-Year Plan is both comprehensive and detailed and consequently is not well suited as a general communication document. The purpose of this summary document is to more succinctly communicate the salient elements without the full coverage and detail provided in the complete 10-Year Asset Management Plan.

This revision of the 10-Year Plan has been developed in an environment where the business has experienced unprecedented challenges. These included: extensive bushfire damage to infrastructure in the Mersey-Forth Power Scheme; low inflows and low lake levels resulting in potentially serious environmental concerns; issues associated with low operating head, low flows and siltation for hydropower turbines; a lengthy and uncertain Basslink outage; considerable challenges with the construction and operation of temporary diesel generation to assure electricity supply and most recently; extensive flooding. Although the business has responded admirably and managed them effectively, these challenges have exposed risks and issues [redacted].

[1] The Regulatory Reporter reports to the Office of the Tasmanian Economic Regulator (OTTER).

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2. Executive Summary

The 10-Year Asset Management Plan (10-Year Plan) outlines the investment, maintenance and operational programmes required for the prudent and long-term sustainable management of the hydro generation assets in Tasmania and the Bass Strait Islands (BSI) generation and distribution assets.

In developing each update of the 10-Year Plan a comprehensive suite of factors are assessed and considered, including Corporation strategy, Wholesale Energy Services requirements, asset event and portfolio performance trends, condition monitoring and performance testing data, intrusive inspection assessments, cost of production and budget constraints. Profiles of investment and activity are assessed to determine the minimum level of capital refurbishment and maintenance needed to sustain production and maintain a prudent overall portfolio risk position for the lowest cost.

The efficiency and effectiveness of asset management at Hydro Tasmania is reflected in the outcomes achieved over the past several years. Significant and sustained operational cost savings, dramatic rebalancing of the portfolio risk position, maintenance and operational practices maintaining outstanding plant performance and increasing core hydro major maintenance capability are some examples. In addition, a culture of innovation, continuous improvement and the pursuit of delivery efficiencies has been established. This effort has realised tens of millions in cost savings to date and embedded future cost savings of over $100m in the coming 10-year period.

at Hydro Tasmania is consistently pushing boundaries.

the portfolio risk position is on an upward trend. Put simply, the number of asset issues is starting to increase at a rate faster than that which the current refurbishment and maintenance regimes are able to address. This culminates in the Corporation progressively being exposed to increasing levels of asset-related business risk. The annual risk review of the portfolio ensures that significant risk movements are considered and communicated.

The state of health and the risk position of the hydro production assets is well known and has been communicated regularly and unambiguously to the Leadership Group and the Board. The hydropower portfolio is advanced in age, operates in harsh environmental conditions and in a market context imposing an onerous running regime

Nearly 40 of the 50 major hydro production lines are past their mid-life point and/or progressing towards end-of-life without major refurbishment.

Increasingly, significant emergent risks are requiring timely attention. Recent examples of this include failure of AC/DC wiring systems, in-service failure of the Bastyan transformer, rock fall risks at several locations (Cethana, Devils Gate, Cluny), ground support integrity issues at Cethana and in-service failure of the concrete lining at Tarraleah forebay spillway.

Increased civil asset inspection and investigations have identified a heightened risk of rock falls in road cuttings leading to hydropower assets, concerns with geotechnical integrity of ground anchoring in tunnels and caverns of underground assets (Gordon and Poatina) and

stability issues with the foundations of a number of canals, (Tarraleah is 75 years old) and pipelines. Other issues of note are the deterioration of pipeline and penstock coatings which will require significant increased investment over the coming 10-years to redress.

The 'as found' condition of mechanical plant disassembled for refurbishment or replacement consistently shows heavy deterioration. Extensive corrosion damage, [redacted] and [redacted] loss of material [redacted].

These occurrences potentially compound the risk already inherent in the 10-Year Plan. The asset strategy prioritises the top 27 production lines (half of the hydro machines), overtly targeting security of 70% of current production levels through an intense 10 years of focussed mechanical intervention. As such, the remaining 30% of production lines receive minimal attention and expose the business to increasing levels of revenue variability associated with the decrease in reliability and availability of these production assets.

The emerging asset issues, latent condition and heavily deteriorated mechanical components are increasingly redirecting expenditure from planned activity to reactive interventions. [redacted]. This in turn is progressively eroding the integrity of the 10-Year Plan, compromising the ability to sustain the productive capability of the assets and managing Duty of Care obligations. These factors combine to indicate both the operating budget and the current capital allocations are proving inadequate to deliver 10-Year Plan outcomes. There is diminishing certitude that the 10-Year Plan is describing the minimum level of investment and activity that the hydro generation portfolio requires.

[redacted], the Investment Management Team (IMT) recently undertook the annual capital planning process and supported an increase in hydropower asset investment of circa 10% over the previous corporate plan forecast. This increase will redress the balance between rate of deterioration and issues resolution and better ensure the turbine and alternator refurbishment programmes (in particular) continue at a rate sufficient to support the ongoing production and revenue requirements of the business.

The highlighted need for modest increases in the supporting operational expenditure is exacerbated by significantly unfunded assets and issues recently transferred to A&I control, such as buildings and non-generational assets (NGA). [redacted] Whilst normalising this 'unique' delivery model realises improved delivery cost, it more importantly provides opportunity to rationalise activity and gain delivery efficiencies that, when combined, will result in material savings, (largely in external contractor expenditure). Identifying operational efficiencies continues to be an imperative and essential to create sufficient 'spare' capacity to manage the issues described above [redacted]

The next three to four year period is considered pivotal to the long-term future of the hydropower portfolio. The ability to develop and maintain sufficient momentum on the turbine and alternator refurbishment programmes, whilst maintaining adequate progress on the identification and resolution of escalating civil asset issues, will be essential to maintaining the reliable levels of plant performance required for revenue generation and retaining a prudent portfolio risk position. Material delays in addressing known and

emerging asset issues will create a potentially insurmountable bow wave of work such that, even if the funds are available at a later stage, it becomes unrealistic to effectively deliver the amount of major projects required to redress the situation whilst sustaining the necessary levels of generation to deliver revenue requirements.

Whilst the preceding description is somewhat sombre, it is important to balance this with the considerable progress made to date and the good work that continues to occur. Whilst currently increasing, the overall risk position in the portfolio has been dramatically reduced from where it was several years ago. Investment in asset type programmes, people skills and staff capability has yielded significant returns for the business and has positioned it well to manage the challenges that will present in future years.

The business has established an asset management system that is efficient and effective; the ongoing commitment to innovation, continuous improvement and productivity gains will ensure investment and expenditure in the asset base continues to be value accretive. Noting that, inclusive of the increased capital and operational funding requirements highlighted, the total annualised cost required to refurbish, maintain and operate the hydropower portfolios will remain under [redacted] per MWh.

The A&I group remain positive and enthusiastic about the challenges associated with maintaining the long-term sustainability of the hydropower portfolio. These challenges and the importance of the business to Tasmania combine to create an invigorating sense of purpose. As the country progressively embraces the importance of renewable energy in constraining carbon dioxide emissions, A&I is confident that ongoing determined implementation of the 10-Year Asset Management Plan will ensure that Hydro Tasmania remains Australia's leading clean energy business and continues to provide value for our owners, inspire pride in our people and build value for our customers.

2.1 Asset Portfolio Risk Summary

Table 1 below summarises the most important considerations for each portfolio in a succinct statement. The full version of the 10-Year Asset Management Plan contains comprehensive descriptions of the current issues and risks.

Table 1: Portfolio Risks - Most Important Considerations

Portfolios	Portfolio Risks
Bass Strait Islands (BSI)	The most important risk considerations on the Bass Strait Islands are the flow-on effects of corrosion-related failures of distribution hardware such as cracked insulators, broken top ties, failed cross-arms in addition to an aged and deteriorated distribution pole fleet. The BSI marine environment, with high levels of salt and moisture combined with high wind, is extraordinarily corrosive [redacted]. Upgrading of distribution protection devices, pole replacements and installation of fit-for-purpose pole-top hardware is a large ongoing programme of work.
Dam Safety	Of the 204 dams in the portfolio, [redacted]. The 10-Year Plan has a focus on strengthening Scotts Peak and Edgar [redacted] whilst also

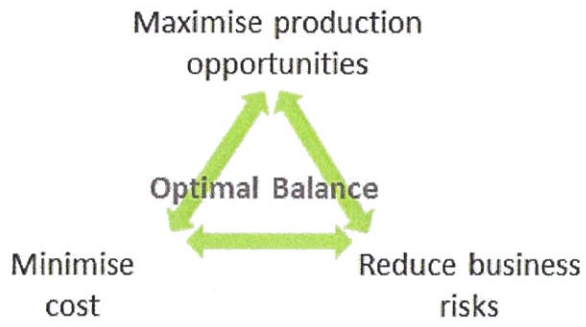
Portfolios	Portfolio Risks
	delivering the Annual Dam Safety Programme to the Regulator's satisfaction. The Scotts Peak and Edgar Dam work will require major expensive interventions. For continuous improvements to the programme the focus will be the management of spillway gates and dewatering outlets and resolution of an extensive catalogue of minor dam deficiencies on a risk prioritised basis.
Civil Asset Portfolio	The majority of the civil assets are advanced in age and subject to weather extremes and highly variable ground conditions. The most significant risk in the water conveyance assets is the Tarraleah system; now some 75 years old. Sections of No. 1 canal and flumes have settled [redacted] Movement and instability of hillside ground supports [redacted] is another [redacted] risk [redacted]. Over 400,000m^2 of coatings that protect water conveyance assets from corrosion and the adverse effects of extreme weather conditions are approaching end-of-life. [redacted] To address these issues, renewal and intervention strategies for canals and flumes, remote monitoring for overtopping, slope stability and integrity of ground anchors for tunnels and caverns (Gordon and Poatina) are included in the current 10-Year Plan.
Mechanical Asset Portfolio	The main challenge is the lack of flexibility remaining in the scheduling of turbine runner and mechanical component refurbishment relative to their remaining safe operating life. [redacted] The major turbine components and runners at Liapootah, Wayatinah, Trevallyn, Lake Echo, Catagunya, Rowallan, Repulse, Cluny, Devils Gate, Lemonthyme and Wilmot are [redacted] due for refurbishment/replacement. Recent disassembly of similar aged machines has exposed [redacted] corrosion, [redacted] material loss [redacted] A turbine integrity programme, in association with monitoring and maintenance activities, endeavours to minimise machine risk consequence while awaiting intervention. The turbine refurbishment programme is a key focus of the 10-Year Plan over the next ten years.
Electrical Asset Portfolio	The average age of the alternator fleet is ~36 years, [redacted] The alternator fleet exhibits signs of age-related deterioration, [redacted] Some units have [redacted] oil and carbon dust contamination [redacted]. The 10-Year Plan includes an extensive programme of refurbishment and replacement of alternators and other high voltage equipment.
Delivery Risk and Compliance	An emerging risk is NEM Compliance where progressively there is less comfort with 'grandfathered' provisions on generator performance standards. Full portfolio compliance with contemporary standards is particularly onerous and would be a prohibitively expensive undertaking. Ongoing support of key stakeholders (AER) is

Portfolios	Portfolio Risks
	increasingly linked to making sufficient progress on the full compliance of major generating units and the integrity of the generator performance standards assurance programme. [redacted] Opportunity lies in the replacement of older governor and excitation systems with modern, digital systems to prevent degradation and improve performance on the system enhancement revenue including ancillary services support to manage Basslink capability.

3. Asset Management

Governed by the requirements of the Corporation's Asset Management Policy to achieve *cost effective enhancement and optimisation of the value creation capability of the hydro asset portfolio*, A&I's business strategy is to ***maximise production opportunities*** and ***reduce business risks*** for the ***minimum cost*** (Figure 1).

Figure 1: A&I Business Strategy



In support of A&I's Business Strategy, the asset management strategic investment priorities are to:

1. discharge all safety, duty of care and regulatory/legislative compliance obligations;
2. maintain the full productive capability of the portfolio on a risk-prioritised basis to support revenue production; and
3. secure approximately 70% of future production and ancillary services by ensuring the top 27 production lines are strong and reliable by 2025.

The 10-Year Asset Management Plan is developed in accordance with the asset management strategy. As such, the 10-Year Plan prescribes a comprehensive set of asset and risk management programmes designed to maintain the operational integrity and sustain the performance of the portfolio over the long-term. As represented in Figure 1, these outcomes are pursued through optimising the tension between three competing priorities: minimising cost, reducing risk and maximising production opportunities.

The outcomes delivered from several successive years of implementing this detailed and holistic asset management framework have been transformative: there has been a dramatic rebalancing in the portfolio risk position, a material reduction in the operational cost base and the business has benefited from outstanding levels of plant performance. In addition to this, the business now enjoys considerably more hydropower intrusive maintenance, refurbishment and project delivery expertise; both core ongoing requirements.

3.1 Outcomes Targeted

At the end of this current 10-year plan period, FYE2026, the following outcomes are being targeted:

- All current high risk asset issues in the 27 highest value production lines will have effective mitigations in place or otherwise be treated and resolved. These 27 strong and reliable production lines will secure 70% of production, provide the majority of peak generation and market ancillary services;
- Four Kaplan turbine major upgrades will be completed reducing a significant environmental oil risk legacy and addressing the production risk from these aged and heavily deteriorated stations;
- The Lower Derwent and Mersey-Forth turbine replacement and refurbishment programme will be completed, and the Tarraleah programme addressing the increasing revenue risk associated with these assets will be completed or substantially progressed;
- All current high risk issues in the Primary Protection Assets will be rectified. These include Spillway and Intake Gates, machine Main Inlet Valves, Hill Top Valves, Turbine Relief Valves and Circuit Breakers (noting that the risks associated with these assets are not static [redacted]
- Replacement of the highest risk machine electrical protection, governor and excitation systems will be completed, providing improved safety and security and AEMO compliance;
- The programme of alternator re-winding and core replacement for those nearing end-of-life will be substantially completed;
- Current end-of-life transformers will be replaced and strategic spares procured;
- [redacted] and the priority earth-filled embankment dams will have undergone improvement work;
- Access tunnel ground support refurbishments at Poatina will be completed;
- Refurbishment of Tarraleah, Fisher and Montpeelyata canals will be completed;
- The civil assets and water conveyance infrastructure refurbishment programmes will be developed and substantially commenced;
- A targeted workforce training and development programme, aligned to the Hydro Tasmania-specific skill sets, will have delivered sufficient capability to undertake the next ten years of asset management activity;
- Public liability risks will be reduced and actively managed for the Non-Generation Assets[2] portfolio;
- Several operational building risks will be mitigated and this asset portfolio will be actively managed;
- Hydro Tasmania will continue to enjoy the benefits inferred by the Special Water Licence, proving itself to be a responsible custodian of this important multi-use resource; and, most importantly

[2] Non-Generation assets refer to lands, parks, boat ramps, accessways and lakes either owned by Hydro Tasmania that are opened to and used by the public.

- The culture of continuous improvement and innovation in asset management practice will ensure the productive capability of the hydropower generation portfolio is sustained and Tasmania continues to enjoy the advantages of renewable electricity generation well into the future.

3.2 Value Proposition: Economic Efficiency and Effectiveness

Over the past six years, Hydro Tasmania has made capital investments of circa $360m in the production portfolio and spent a further circa $270m on the maintenance and operational risk management programmes specified in the 10-Year Plan. A number of methodologies have been previously presented to assess the effectiveness of this investment and expenditure. Whilst noting the subjectivity, these assessments all indicate the nett present value (NPV) of the 10-Year Plan is significantly positive. In this edition of the 10-Year Plan an assessment against the Asset Management Priorities is presented as an indication of effectiveness.

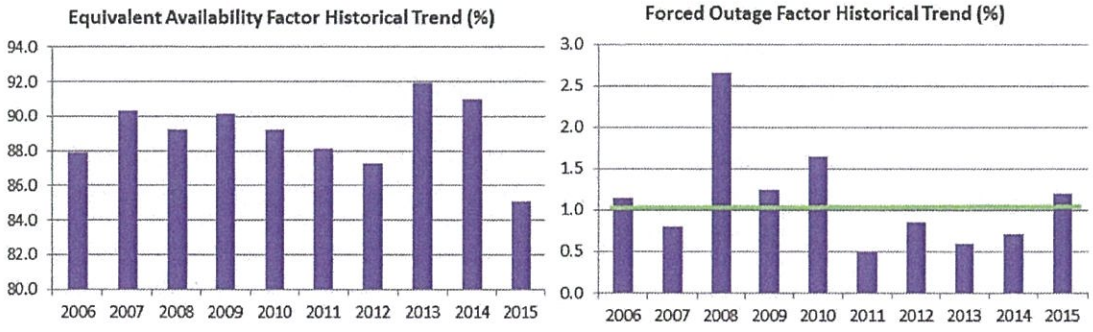
3.2.1 Effectiveness of the 10-Year Asset Management Plan

Through the perspective of the asset management strategy, *effectiveness* is determined by assessing the balance achieved between maximising production opportunities versus the reduction in business risk versus minimising costs.

Maximise Production Opportunities

Standard machine performance metrics of Forced Outage Factor (FOF) and Equivalent Availability Factor are used to assess "production opportunities". Wholesale Energy Services requires high portfolio availability (>80%) and low occurrence of forced outages (<1%) to maximise revenue. The historic performance of these metrics is presented in Figure 2.

Figure 2: Production Opportunity Performance Trends



Availability

Interpreting the availability trend is not intuitive. The decline in 2011 and 2012 was contributed to by both asset failure and the preparatory/proactive work undertaken prior to the carbon price period to ensure high levels of machine reliability.

Availability, whilst currently tracking comfortably above the 80% target, is expected to decline as a result of the ongoing extensive programme of extended machine outages needed to undertake the major intrusive refurbishments required to sustain the productive capability of the machines into the future.

Forced Outages

From 2010 the 10-Year Plan has detailed maintenance and operational risk reduction programmes specifically targeted to minimise plant issues that result in forced outages. These are very impactful from both a generation performance perspective and the efficient/effective utilisation of resources, usually requiring unplanned reactive effort to redress. This results in other planned activity being deferred or requiring additional resource/effort to complete.

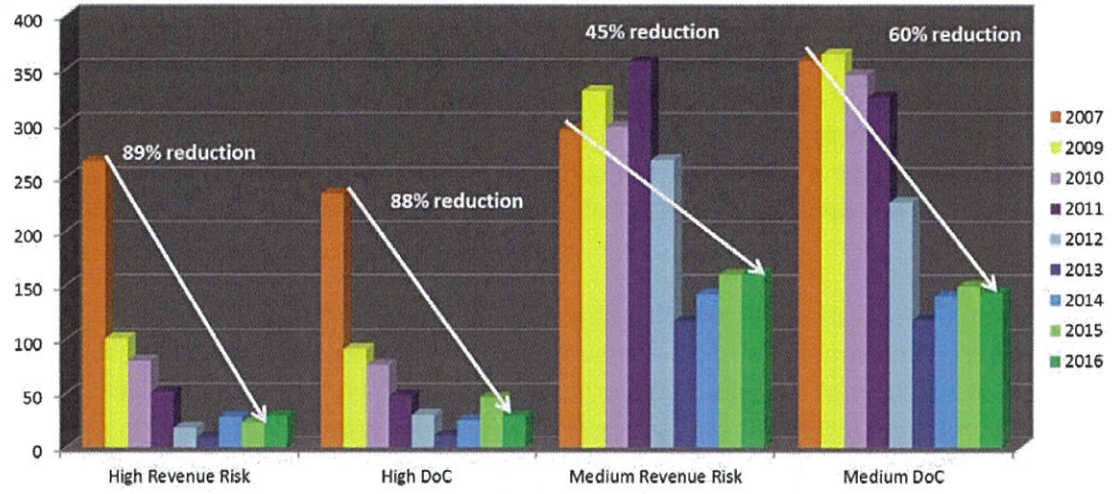
Analysis of the 2015 forced outage performance is the forced outage factor in 2015 increased despite the *number* of asset events remaining steady (approximately). Typically the issues being encountered are more complex or multi-faceted and often take longer to resolve. This in turn increases the forced outage factor; over time an increasing forced outage factor will be detrimental to revenue maximisation.

A key A&I Balanced Scorecard metric utilised for a number of years is the 'customer' (WES) assessment of plant and operational performance. This is conducted as part of routine monthly activities and annually, formally assessed. Whilst much healthy tension and debate ensues throughout the year, ensuring robust and balanced outcomes, the formal assessments have characteristically been highly complementary. The WES customer value proposition centres on attributes such as plant availability and reliability and also operational flexibility and responsiveness.

Reduce Business Risks

From the perspective of effectiveness in reducing business risk, targeted operational maintenance and investment programmes have resulted in a dramatic rebalancing of the hydropower portfolio risk position. There has been a material reduction in the number of asset issues representing high revenue or high duty of care risks since 2010. Asset risk issues, presenting a medium revenue and duty of care risk, have also been materially reduced over this period, as shown in Figure 3.

Figure 3: Asset Risk Issues from FYE2007 to FYE2015



From the perspective of effectiveness in asset issues resolution, Table 2 shows that for the asset issues known to require addressing from 2010 to 2025, 32% of these have been resolved in the first five years of the 15-year period, as planned.

Table 2: Cumulative Achievements of the 10-Year Plan from 2010 to 2025 (excludes Civil and Dams)

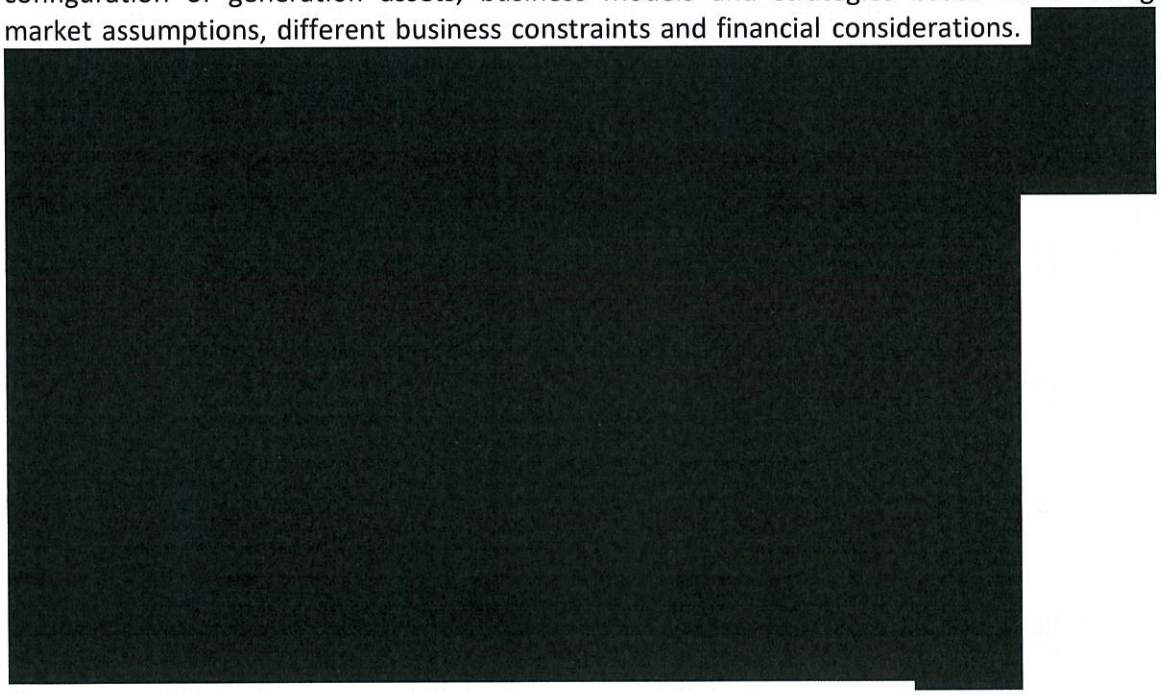
Asset Programmes	Cumulative Resolution Of Issues (Refurbishment/Replace/Treat)		
	Resolved FYE2010 to FYE2015	Planned FYE2010 to FYE2025	%
Transformers	17	28	60
Circuit Breaker	30	69	43
PPA Gates and Valves	32	81	40
Electrical Protection	21	60	35
Non- PPA Gates and Valves	11	43	26
Governors and Excitation	15	63	24
Turbines	9	45	20
Alternators	3	19	16
Mechanical Protection and Controls	5	33	13
Total Completion	**143**	**441**	**32%**

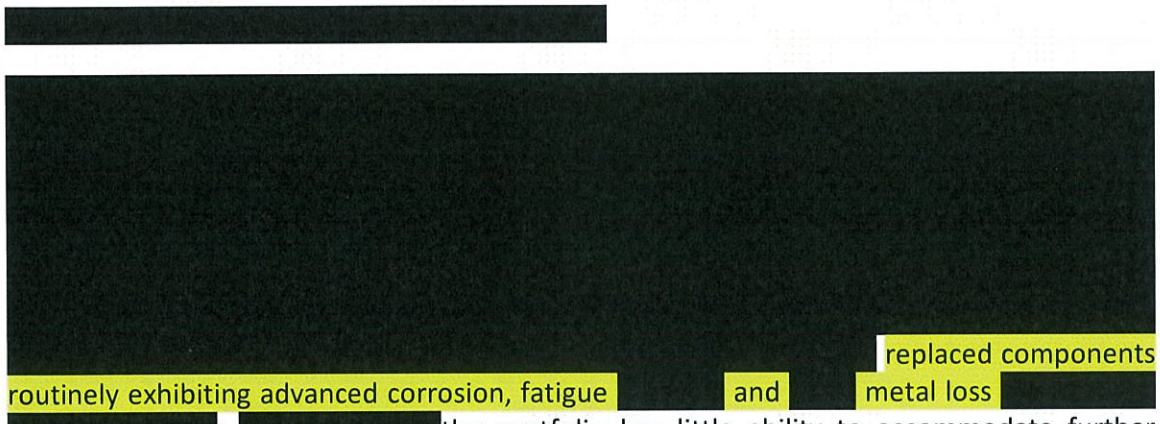
Whilst the business risk reduction achieved to date is laudable, it is not a static position. Asset issues continue to emerge and/or progress from low to medium to high risk. [redacted].

Minimise Costs

The 10-Year Asset Management Plan is based on an overt objective to target the minimum sustainable level of investment and expenditure required to maintain a prudent portfolio risk position and leave a sustainable legacy for the future. Given the scale, age, condition and operational demands on the portfolio, determining what this minimum amount with certitude is not straightforward. In regard to capital investment, the analysis of various counterfactual scenarios is ultimately the primary determinant. That is, if less is spent, assess what would not be done as a result of reducing investment and the risks that accrue from this.

More traditional methods such as benchmarking with other organisations to compare the level of capital investment and the operating and maintenance costs of managing generation assets is problematic. Each organisation will have its own unique physical configuration of generation assets, business models and strategies based on differing market assumptions, different business constraints and financial considerations.





replaced components routinely exhibiting advanced corrosion, fatigue and metal loss . the portfolio has little ability to accommodate further deferral whilst prudently discharging duty of care obligations, or enable the ongoing operation of the asset.

As such, if intending to retain the full productive capability of the portfolio, it would be difficult to make a case that less could be invested in the portfolio.

An examination of the operational cost performance over time illustrates a strong commitment to cost containment and continuous improvement. When compared to operational costs expended in 2006, asset management costs have decreased by ~20% in real terms over a nine-year period, as illustrated in Figure 5.

Figure 5: Operations and Maintenance Cost Reduction Trend

Note: Real term calculation based on ABS All Groups CPI Australia from 2006 to 2015.

This period has also been characterised by a significant improvement in productivity levels resulting in an increase in maintenance activity being performed and the addition of important asset testing and assurance programmes. Both improve asset management outcomes as reflected in plant performance metrics.

Still another lens through which to view cost performance is to determine the total 'production' cost incurred for operations, maintenance and capital refurbishment per unit of energy delivered. That is, compare $/MWh to NEM market price and assess the competitiveness of product 'manufacture'.

On the basis of an average 9000 GWh electricity production, the annualised production cost for the portfolio is circa $12/MWh, Capex $6.5/MWh and Opex $5.5/MWh. This compares favourably with an average market price of $40/MWh[3] in the past 10 years and $54/MWh this financial year. If the previous 10 years was included in this analysis, a period where little investment occurred, then the average annualised 'production cost' would be circa $10/MWh[4]. The 'production cost' is forecast to remain under $14/MWh over the coming years, even with the proposed increase in capital and operational budgets.

[3] AEMO published historical average prices
[4] Production cost vs market price analysis excludes LGCs, ancillary services revenue and Basslink IRRs

The aforementioned factors; industry comparisons of capital investment, operational expenditure restraint for an extended period of time, the relatively low production cost[5] compared to the NEM price, refurbishment frequency

all support
that management of the production portfolio is being undertaken at the minimum cost to leave a sustainable legacy for the future.

In conclusion, through the perspective of the Asset Management Priorities *effectiveness* in achieving a balance between maximising production opportunities versus the reduction in business risk versus minimising costs has been an outcome delivered through the implementation of the 10-Year Asset Management Plan.

3.2.2 Economic Efficiency

The previous section detailed the *effectiveness* of the 10-Year Plan in delivering the asset management priorities. This section considers the *economic efficiency* in delivering these outcomes by estimating the 'return of the investment' in terms of the revenue the portfolio provides and presenting examples of material delivery cost savings and productivity improvements realised (and planned) in the delivery of the 10-Year Asset Management Plan through innovation and continuous improvement.

Return on Investment

Previous DCF analysis presented to the Board on the 10-Year Asset Management Plan demonstrated, under a range of reasonable assumptions, the NPV of the investment and expenditure prescribed in the 10-Year Plan is significantly positive; in the range of $0.5b to $2.0b and develops an IRR in the range of 12% to 28%. Furthermore, the very wide range of scenarios that resulted in a positive NPV result gives confidence that the 'returns' facilitated by implementing the 10-Year Plan are highly positive with a very low probability of a 'return' less than the WACC .

Therefore, the implementation of the 10-Year Plan can be described as an efficient allocation of financial resources in that it produces an excellent 'return' by investing in the core assets and activity of the business.

Procurement and Programme Delivery

In addition to the significant operational cost savings realised, as illustrated in the preceding Figure 5, a keen ongoing focus on productivity improvement, innovation and continuous improvement has also realised material improvements in capital works programme delivery and procurement.

Improvements have been generated across a diverse activity range, including: procurement practices; innovation in design and solution development; OEM partnering; adoption of risk-based asset management; investing in contractor upskilling and development; blended

[5] This refers to direct production cost calculated on all costs to A&I only and exclude all other costs incurred across the business.

service delivery; and insourcing core functions. Examples of the savings generated or improvements made include the following.

The risk-based approach to Dam Safety developed and championed by Hydro Tasmania yields around $1.3m of operation expenditure savings per annum,

. Further, significant capital investment savings are achieved by targeting tolerable risk positions for existing dams,

Growth in building capability sufficient to adopt the head contractor role for the Catagunya dam upgrade enabled the business to realise savings of over $5m over a tendered outsourced model. Similarly, insourcing the refurbishment of the first three machines at Tungatinah realised savings of over $7m against a tendered outsourced model. This insourced model realises savings in the order of 10% for each major machine refurbishment project going forward.

The bulk procurement of the four Kaplan turbines from one manufacturer generated circa $8m in savings over a standard procurement approach. Bulk ordering the next series of Francis turbine runners has generated a further circa $10m in savings and a similar approach to the procurement of 11 generator stators has realised circa $24m in savings over the previous procurement model.

Innovative approaches and partnering with OEMs has resulted in the development of a standard design approach for several asset types which has yielded significant savings including: $3m for large valves; $40m over ten years for mechanical protection and control assets (Figure 6); a further $5m savings through a more in-house design and supported governor replacement programme (Figure 7); and a circa 20% savings generated through partnering with ABB on equipment supply and progressive insourcing of excitation system testing.

Partnering with Stornaway to develop a best practice roads management model has generated a reduction in the road risk rating index from circa 21000 to 550 with very modest levels of capital investment and maintenance expenditure. This dramatic reduction in road safety risk was achieved whilst generating very material reductions in road expenditure against external benchmarks for roads management.

The investment of time and effort in electrical installation contractor RBD has yielded material reductions in station upgrades over time. The quantum of the efficiency gain and cost savings realised is starkly illustrated through a recent competitive tender evaluation for an upcoming station refurbishment; the RBD tender price was $0.8m versus the alternative preferred supplier at $2.5m.

The cost savings from delivery efficiencies realised to date and the now standard approaches embedded in the next 10-year plan period are estimated to be over 10% of the total capital investment and operational expenditure (over the 16 years from 2011 to 2026) against previous/traditional capital delivery and operational modus operandi.

In addition to cost savings, the procurement and contracting approach has resulted in the opportunity to pursue innovation and realise many material value-add opportunities. This has included participating in bespoke 'in-house' training that has qualified Hydro Tasmania

staff to install and commission proprietary equipment. The approach realises significant savings in project delivery and increases flexibility by not having to rely upon very expensive engineering support from European OEMs. This training simultaneously develops internal engineering knowledge and capability and the competence to undertake future refurbishment and repairs when required. This is a key element of the engineering knowledge transfer and staff development initiative.

Figure 6: Cost Savings of the Standardised Controls Programme

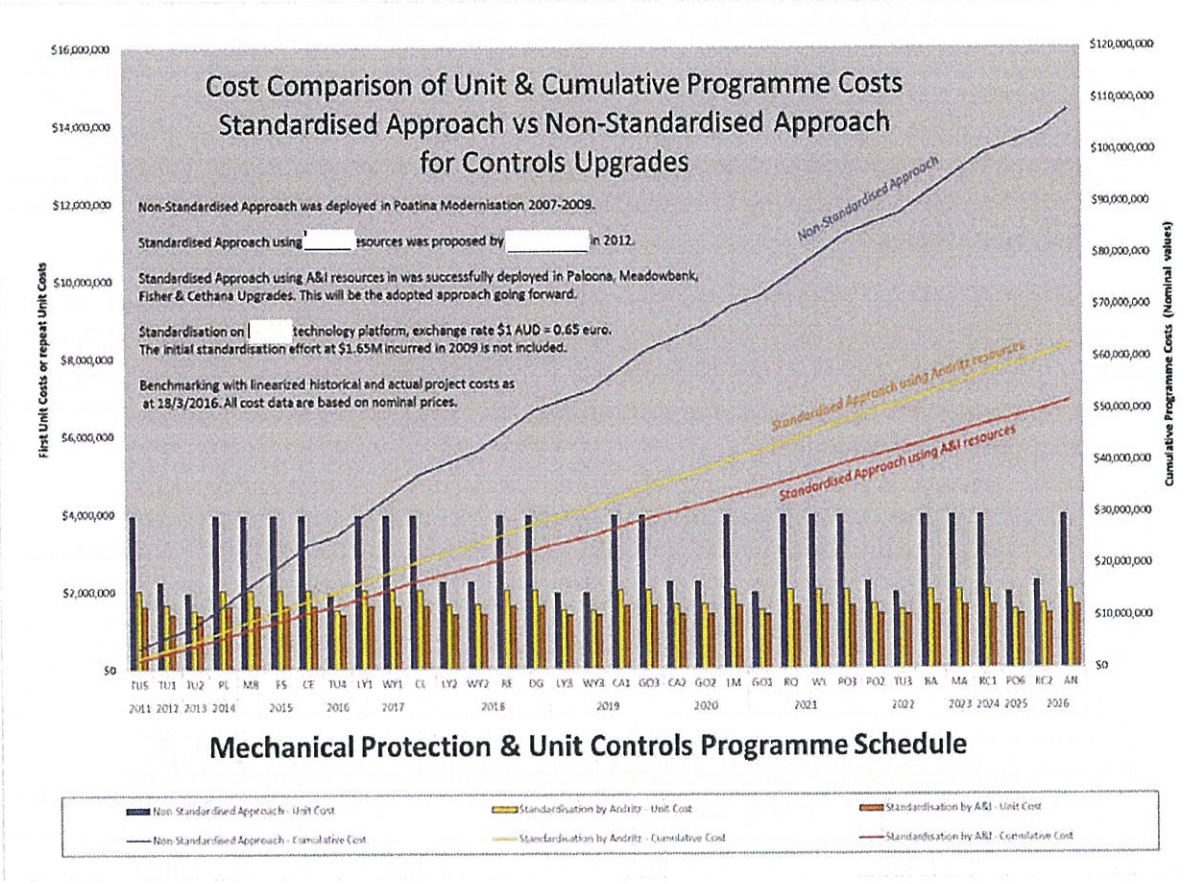
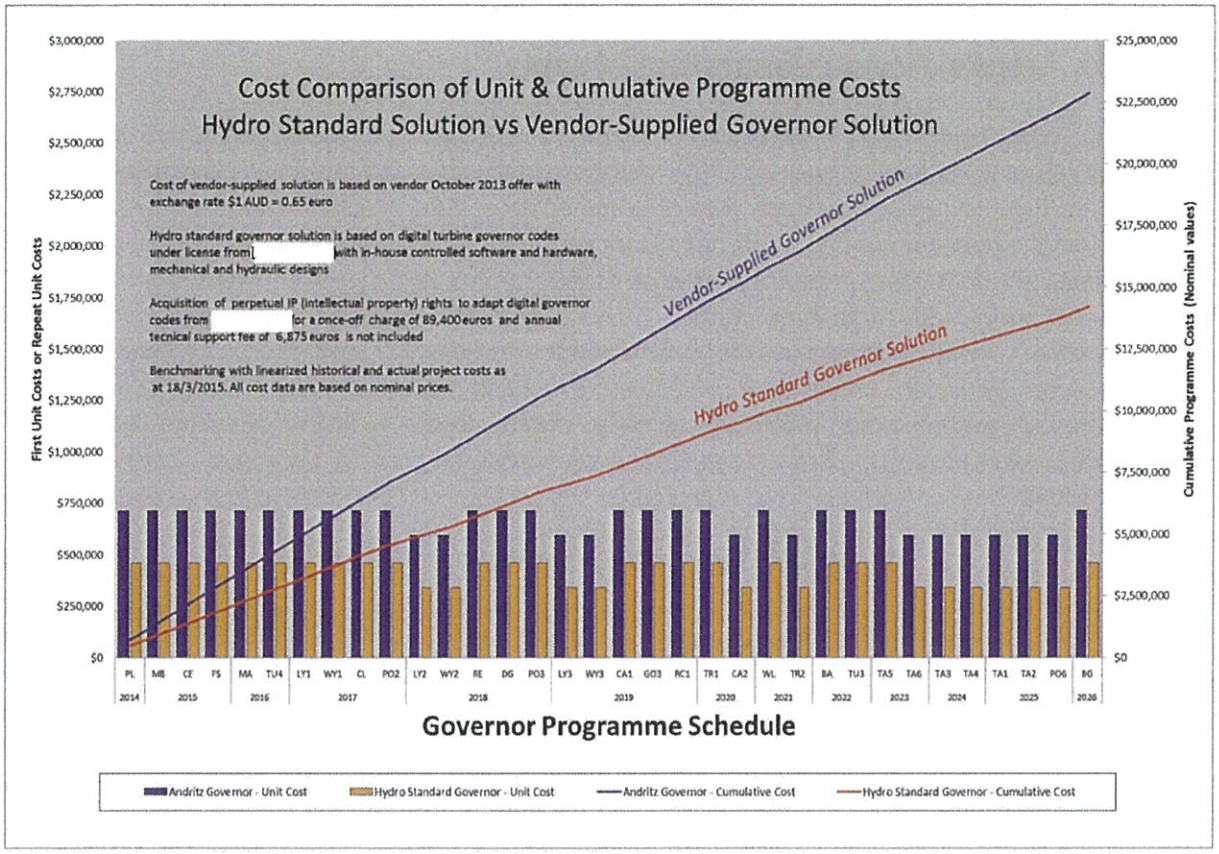


Figure 7: Cost Savings of the Standardised Governor Programme



The culture of innovation, continuous improvement and operational excellence established in A&I will ensure further efficiency and effectiveness gains are realised in the delivery of capital works and operational programmes prescribed over future successive 10-Year Asset Management Plans.

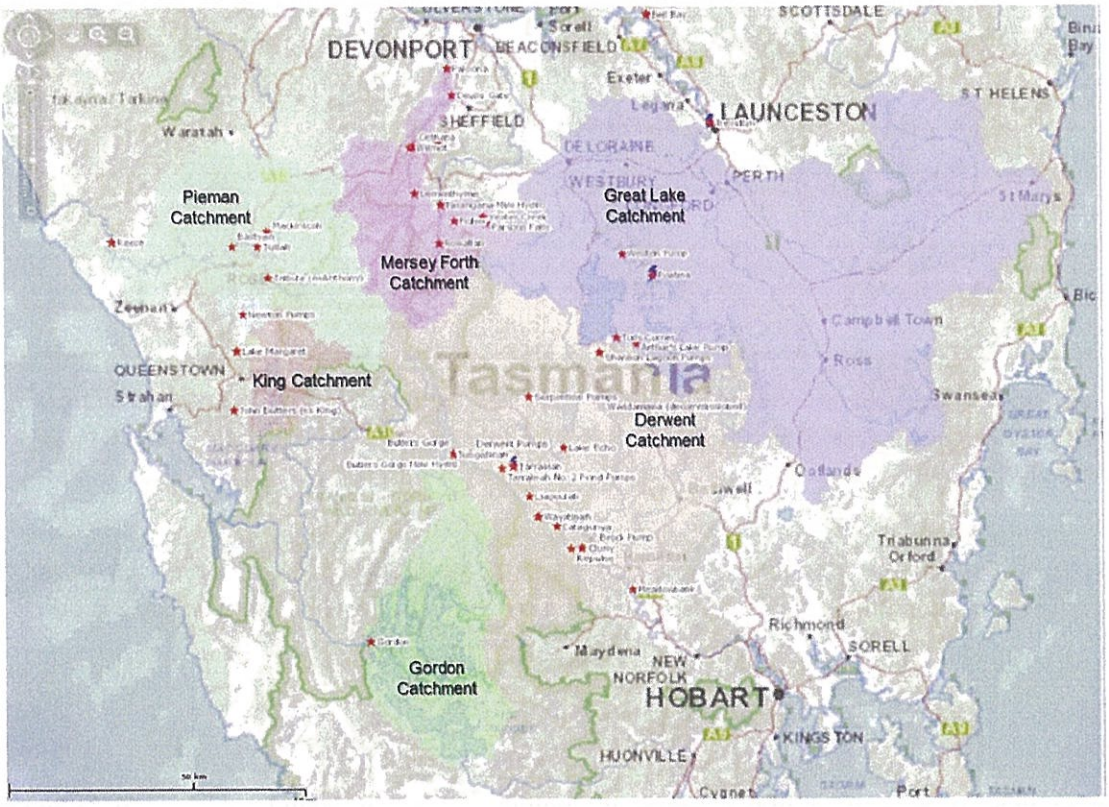
In combination, the improvements and advances made in efficiency, effectiveness and capital works and operational programmes economics in delivering the outcomes achieved, result in the implementation of the 10-Year Plan presenting a compelling value proposition.

4. The Asset Base

4.1 Hydro Power Generating Assets

The hydropower asset portfolio is diverse, extensive and geographically dispersed throughout Tasmania (Figure 8). The stations and water conveyance infrastructure are often located in remote areas with limited supporting infrastructure and services. Whilst distances between stations and operational centres appear relatively short, the terrain is typically mountainous, requiring extended travel times and providing logistical challenges for personnel and equipment access. The geographic dispersion and large number of machines in the portfolio provides tremendous flexibility in generation. However, this presents significant challenges in effectively managing the asset base. The hydropower portfolio contains over 1600 key delivery chain assets (KDCA[6]) distributed over 61 hydropower production lines. Table 3 below provides details of the key assets classes in the portfolio.

Figure 8: Catchment and Hydro Power Stations



[6] A KDCA is defined as one essential to the operation of a production line – failure of a KDCA stops that production line

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Table 3: Overview of Asset Portfolio

HYDRO TASMANIA GENERATION PORTFOLIO			
Generation Capacity	2284 MW (Hydro); 140 MW (Woolnorth Wind Farm)		
Power Stations	30 (includes Upper and lower Lake Margaret, Tods Corner, 2 Mini Hydros)		
Production Lines	50 major hydros + 1 Tods Corner + 2 Mini Hydros (Parangana+Nieterana) + 7 Upper Lake Margaret + 1 Lower Lake Margaret		
Pumping Stations	Arthurs Lake, Shannon Lagoon (2 units), Weston, Derwent Pump (4 units), Serpentine (2 units), TA#2 pond (3 units)		
	Newton (3 units), Parsons Falls (3 units), Yeates Creek, Brock Pump		
Catchments & Storages	73		
Land	119,000 hectares		
Dams (major)	55		
Dams (minor)	149		
Intakes	46		
Outlets	14		
Tunnels	70 total 71 km		
Canals	80 total 211 km		
Flumes	32 total 69 km	Property	675
Pipelines & penstocks	103 total 54 km	Other Buildings	108
Pumping Stations	11	Public Facilities	146
Tailrace	29	Buildings	33
Roads	258 total 625 km	Boat Ramps	165
Bridges (Vehicular)	79	Jetties	88
Bridges (foot)	111	Quarries	15
Area of int/ext pipe/penstock coating	400,000m^2	Stockpiles	13
Remote Monitoring Sites (hydrometric)	200	Helicopter Landings	1
RemoteSensors (hydrometric)	~700	Easements	25

Scheme	Power Station	Commission Date	Age to 2016	No. of Machines	Turbine Type
Derwent	Lake Echo	1956	60	1	Francis
Derwent	Butlers Gorge	1951	65	1	Francis
Derwent	Tungatinah	1953	63	5	Francis
Derwent	Tarraleah	1938	78	6	Pelton
Derwent	Liapootah	1960	56	3	Francis
Derwent	Wayatinah	1957	59	3	Francis
Derwent	Catagunya	1962	54	2	Francis
Derwent	Repulse	1968	48	1	Kaplan
Derwent	Cluny	1967	49	1	Kaplan
Derwent	Meadowbank	1967	49	1	Kaplan
South Esk	Tods Corner	1966	50	1	Francis
South Esk	Poatina	1966	50	6	Pelton
South Esk	Trevallyn	1955	61	4	Francis
Mersey-Forth	Fisher	1973	43	1	Pelton
Mersey-Forth	Rowallan	1968	48	1	Francis
Mersey-Forth	Lemonthyme	1969	47	1	Francis
Mersey-Forth	Wilmot	1971	45	1	Francis
Mersey-Forth	Cethana	1971	45	1	Francis
Mersey-Forth	Devils Gate	1969	47	1	Francis
Mersey-Forth	Paloona	1972	44	1	Kaplan
Gordon	Gordon	1977	39	3	Francis
King	Butters (King)	1992	24	1	Francis
Pieman	Tribute	1994	22	1	Francis
Pieman	Mackintosh	1982	34	1	Francis
Pieman	Bastyan	1983	33	1	Francis
Pieman	Reece	1986	30	2	Francis
Lake Margaret	Lake Margaret	1914	102	7	Pelton
				58	
	Mini Hydros			3	

The nominal mid-life for a well maintained hydro generator operated in its efficient operating range is circa 40 years, as depicted in Figure 9. In terms of the age-related production risks, around 63% of annual production is generated from production lines that are over 40 years old and approximately 20% are older than 60 years.

In terms of age-related condition and performance asset risk, 42 production lines (Poatina, Trevallyn, Mersey-Forth and Derwent) are greater than 40 years old. Those in the upper Derwent, with extensive civil and water conveyance infrastructure, are older than 60 years.

These simple statistics largely encapsulate the asset management challenges and consequent risk to revenue confronting the corporation.

Figure 9: Production Age Profile

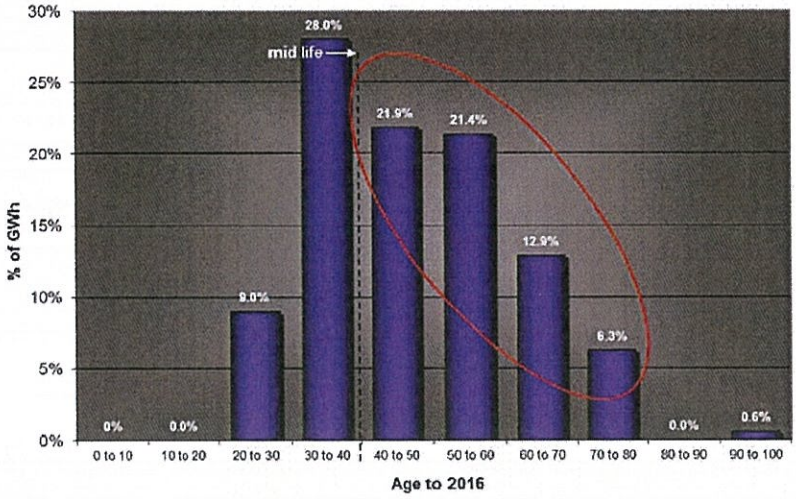
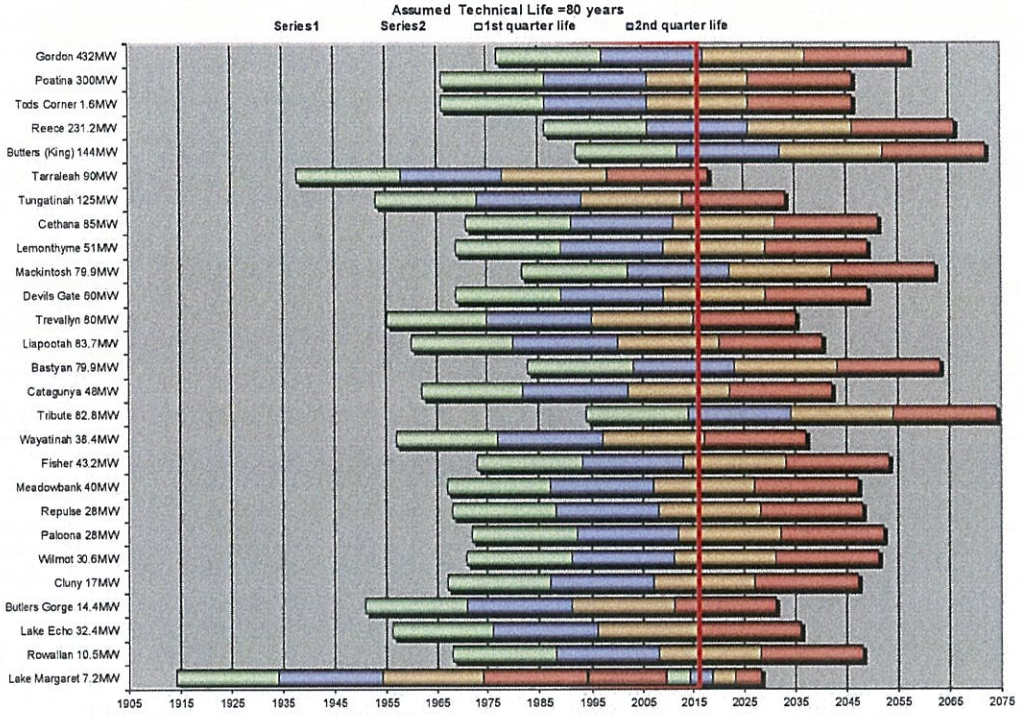


Figure 10: Hydropower Station Mid-Life Profile



4.2 Bass Strait Islands (BSI)

Hydro Tasmania has accountability for generation, distribution, retail (through Momentum) and system control on the BSI. The risks associated with the electricity supply activities on the BSI primarily centre on the distribution reticulation infrastructure and operations. The power pole fleet is aged and deteriorated and the pole top hardware and transformers are subject to extraordinarily corrosive conditions and large replacement and maintenance programmes are required to rectify. Another significant area of risk exposure is the management of vegetation around overhead power lines. In addition to these asset-related risks, the BSI present unique challenges in attracting and retaining experienced and committed staff. [redacted] This issue manifests most acutely through the frequent storm activity that lashes the islands and disrupts power supply. This routinely creates challenging operational conditions for linepersons in restoring power. This reactive effort frequently disrupts planned activity, further exacerbating the asset maintenance issues and requires staff to work unsustainable on-call rosters.

The key asset and customer information is detailed in Table 4 below.

Table 4: Bass Strait Islands Assets

	Flinders Island	King Island
Customers (total sites)	740	1,326
- Residential	600	1,036
- Business	140	290
- Industrial	0	0
Annual consumption (MWh)	4,045	10,944
Peak demand (MW_{peak})	1,240 kW	2,500 kW
Connected kVA	6350	16703
11 kV Overhead reticulation (km)	330	400
Number of power poles	3950	4788
Number of distribution transformers	262	471
11 kV Underground cable (km)	0	1.2
Customers per km route length	2.1	3.1
kVA per km route length	19.2	41.76
Number of Feeders	3x11kV	4x11kV
Generation		
- Diesel	2x720 kW; 1x300 kW; 1x 1200kW	3x1600 kW; 1x1200 kW
- Wind	Privately owned: 1x60 kW; 1x25 kW; 1x300 kW	2x850 kW; 3x250 kW
- Solar	Grid connected domestic (non-dispatched): 188 kW	Grid connected domestic (non-dispatched): 361 kW

King Island

- Currie Power Station was commissioned in 1985. The station currently consists of four Caterpillar diesel-generating units with ratings as detailed in the table above, plus the Huxley Hill wind farm; consisting of two 850 kW Vestas and three 250 kW Nordex wind turbines.
- The Currie Power Station is also home to the innovative KIREIP; this is progressively decreasing the use of diesel generation through the integration of synergistic technologies. This has facilitated King Island to operate on zero diesel for a continuous maximum period of 60 hours and just over 3000 hours in total.

Flinders Island

- Whitemark Power Station was commissioned in 1984. This station consists of four Caterpillar diesel generating units with ratings as detailed in the table above.
- A project at Whitemark Power Station is currently installing equipment that will also facilitate more renewable energy generation and reduce diesel consumption.

5. Business Risks

Hydro Tasmania is exposed to a number of material business risks as a result of the asset intensive nature of its production operations. The most likely manifestation of these risks is summarised below.

Revenue

The current 10-Year Asset Management Plan results in the alternator and turbine portfolios typically approaching 60 years of age by the time refurbishments are implemented, [redacted]. This is an advanced age for this type of equipment [redacted].

[redacted]

Safety/Duty of Care

Though well understood and managed accordingly, the business has a legacy of exposure to materials and practices of the past with an extensive asset base that is typically not built to modern day standards and expectations. [redacted]

The assets are typically located in remote areas well away from population centres and accessed via basic road infrastructure and often subject to harsh weather conditions. This results in a large exposure to personnel risks associated with driving. At more than 4 million, the aggregate kilometres being travelled by staff are akin to that of a transport company. These risks are well understood and typically well managed, thus incident likelihood is low. However, the consequence of such incidents is potentially very high.

The Corporation has an extensive land and waterway ownership and a material public safety risk exposure emanating from the amenity these afford to the general public. [redacted] many of the assets are also easily accessible to the public, [redacted]

Market/Regulatory

An emerging risk associated with the asset base is market access as a result of the AER and AEMO becoming progressively less comfortable and accepting of 'grandfathered' provisions

on generator performance standards. Full portfolio compliance with contemporary standards would be particularly onerous and a prohibitively expensive undertaking. Ongoing support of key stakeholders (AER) is increasingly linked to making sufficient progress on the full compliance of major generating units and the integrity of the generator performance standards assurance programme. [redacted]

Environment

The most likely asset event that results in significant environmental damage is the failure of equipment that leads to an uncontrolled release of oil into pristine waterways, the largest exposures being:

- The two remaining Kaplan turbines at Cluny and Repulse [redacted] and
- A serious electrical fault or catastrophic failure of a transformer has the potential to result in a very large volume of oil [redacted] to be released into rivers or waterways.

Other less likely initiators of serious environmental harm are associated with the failure of a water conveyance or dam resulting in large uncontrolled release of water that has the potential to reap serious environmental damage.

Major risks posed to the Corporation by the environment emanate from flood and fire; 2016 has evidenced the rampant destructive power of each.

Water Resource

Hydro Tasmania is the largest water manager in Australia and enjoys [redacted] access to these resources for electricity generation. This [redacted], along with the renewable attribute of the electricity generated, is arguably the Corporation's most valuable asset. [redacted]
Consequently, [redacted] it is essential Hydro Tasmania is and is seen to be a responsible custodian of this shared resource and [redacted].

Reputational / Brand

The most likely asset/operations related initiator causing serious reputational/brand damage is the adverse publicity associated with one of the risk events referred to above.

5.1 Rotating Plant Portfolio Risk Profile

The age and [redacted] deteriorated condition of the electrical and mechanical rotating portfolio presents material revenue and safety business risks. [redacted]

[redacted]

The average station age is 50 years (excluding Lake Margaret, which is 100 years old). [redacted] Major intrusive maintenance interventions at circa 30 year intervals are considered essential to realising the full productive life of the asset at the lowest cost and prudently managing high risk failure modes.

The condition of internal equipment and components disassembled for refurbishment or replacement consistently shows [redacted] deterioration, [redacted] corrosion and [redacted] loss of material. Condition monitoring and performance testing results are also consistently indicating signs of decline. [redacted] These risks are exacerbated because the most likely failure modes are not able to be effectively monitored without disassembly. The rotating plant risks are being intensified by:

- mechanical fatigue, [redacted]
- cavitation and vibration damage, [redacted];
- degradation of alternator electrical insulation, [redacted]; and
- mechanical fatigue [redacted]

5.2 Electrical Asset Portfolio Risk Profile

The Electrical Protection portfolio is critical to the safe and compliant operation of the Hydro generation system. [redacted] As such, these ageing electrical protection assets continue to be afforded a high priority under the 10-Year Asset Management Plan for timely and progressive replacement.

Mechanical protection and control systems in service that are electro-mechanical and analogue electronic types are progressively replaced with modern digital technology. These older technology systems are operating towards end-of-life, [redacted] and [redacted] are not supported by manufacturers, [redacted]. Modern digital units provide significantly improved functionality for remote engineering network communications, condition monitoring, fault detection and diagnostics capabilities.

Governors and excitation systems that are operating towards end-of-life and with [redacted] older technologies are also scheduled to be replaced with modern digital technology systems that have good connectivity with our controls systems for much improved communications, condition monitoring, fault detection and diagnostics capabilities.

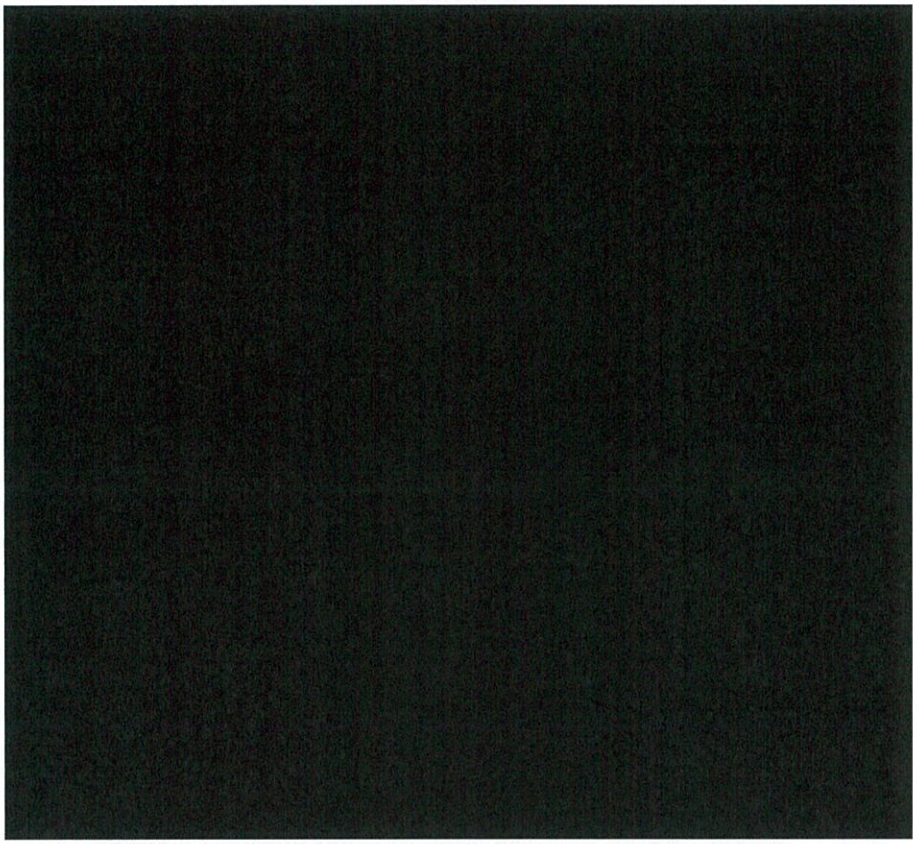
All our headworks protection and communication systems that control the operation of our gates and valves, protecting our civil and water conveyance infrastructures, are of the older technology [redacted] nearing end-of-life. These are progressively scheduled to be replaced with modern technology to ensure these protection devices are reliable for communication and operation.

5.3 Dam Portfolio Risk Profile

For the dam portfolio, the risk position for each dam with life safety risk is determined by quantitative risk assessment and plotted against the ANCOLD limit of tolerability for existing dams. [redacted]

- Scotts Peak This dam is [redacted]. Designed and built to rock-fill embankment specifications, [redacted]
- Edgar [redacted]
- Murchison [redacted].

[redacted]



5.4 Civil Portfolio Risk Profile

The risk position of the civil asset portfolio is dominated by the water conveyance infrastructure of canals and flumes, tunnels, pipelines and penstocks. Other asset classes also present risks, but are generally less dynamic and potentially less rapid in onset or initiation. These assets include intakes and forebays, station post tension rock anchors, ground support systems, bridges, roads and access ways and other ancillary civil structures.

These assets are typically of advanced age and are often located in spatially challenging and exposed environments and as a result, are generally degraded. Whilst they have served the business well for an extensive period of time, these assets were constructed in an era where technology, equipment, materials and standards were very different from contemporary best practice. [redacted]

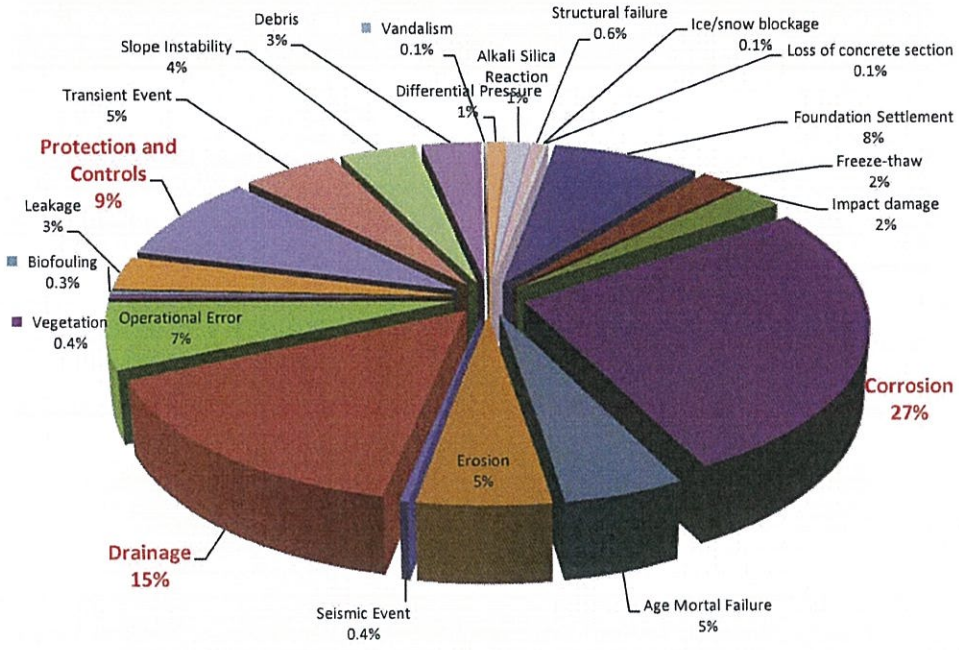
Asset models, (condition decay curves), for the following civil asset classes have been developed. These include civil asset types from Intakes to Main Inlet Valve (MIV) only and exclude ancillary structures and tailraces:

- Canals and flumes – feeding 17 stations, 40% of portfolio production;
- Penstocks and Pipelines – feeding 12 stations, 29% of portfolio production;
- Tunnels; and
- Intakes and forebays.

These asset models provide a perspective on the estimated rate of deterioration of the asset and therefore the residual life expectancy. These asset models indicate that a sustained period of refurbishment for the water conveyance assets will be required to commence towards the end of the current 10-Year plan period. Detailed construction solutions to manage these risks are under investigation.

Integrity of geological foundations supporting civil assets, (e.g. penstocks and pipelines) will be key issues across the portfolio of hydropower stations over the coming period as they continue to age.

Figure 12 Water Conveyance Portfolio Causal Factor Distribution



5.5 10-Year Asset Management Plan Execution Risks

The 10-Year Plan is formulated to identify, analyse, quantify and manage the risks associated with the production portfolio. There are a number of key determinants upon which successful execution of the 10-Year Plan is contingent, the most material of these being summarised below.

5.5.1 Specialist Skills and Facilities

The business has been relatively effective thus far in managing a period of transition where a number of the staff with extensive hydro asset specific expertise have retired over the past several years. The challenges associated with this will peak over the next two to three years as the remaining experts, upon whom we are critically reliant, are also expected to retire

The risk that manifests from this lost asset specific expertise is primarily the ability to maintain, service and operate the extensive amounts of [redacted] equipment and systems of which the production portfolio comprises. These skills are unique and rapidly diminishing, the equipment and systems infrastructure is typically no longer supported by OEMs and the ability to train and pass on knowledge and expertise is generally limited to the opportunity afforded through repair of failures.

The focus of the work programme over the coming 10 year period is primarily on rotating plant, specifically turbine runner replacements and mechanical component refurbishment. [redacted] Given the lack of these skills in the market and the suboptimal [redacted] results delivered when this work was outsourced to specialist OEMs, an internal development programme has been running for the past three years. This enables the business to leverage off the very high level of expertise resident in two to three current staff to progressively upskill and 'in-source' the provision of these skills. This programme to develop the next generation of specialist hydro mechanical expertise has yielded significant success. Supplemented with the successful targeted recruitment of another two individuals, the business is now relatively well placed to manage two to three major refurbishments per annum. The goal now is to extend this programme to develop sufficient capability to manage three to four major refurbishments per annum and the eventual retirement of the existing ageing experts.

One of the major determinants of success is the ability to effectively manage the ubiquitous emergent and latent issues that are encountered upon disassembly and are unforeseeable in planning. One of the key risk mitigations in this regard is ready access to the specialist large scale machines required for the hydro plant that are not available from the general heavy engineering workshop service providers. Without such access, machine outages running at a cost of hundreds of thousands of dollars per week, (plus associated spill of potentially similar amounts), could routinely be held up for several weeks whilst equipment/components were shipped to mainland workshops. The recent securing of the (formerly) Alstom workshops in Cambridge and the recruitment of the specialist machinist expertise required to undertake this work has provided considerable insurance against this risk.

5.5.2 Knowledge Management and Systems

The effort and rate of activity required to maintain the performance and a prudent risk position of the asset portfolio continues to increase year on year. As such, significant productivity and efficiency improvements are required year on year to keep pace. A key enabler to keep pace with this challenge is the modernisation of knowledge management systems and use of technology to facilitate a more efficient and contemporary engineering work delivery model. As an example, A&I is trialling new technology platforms to reduce the need for key technical staff to make several hour-round trips to a remote location to spend two days resolving a technical issue, whilst at the same time reducing the exposure to the risk of driving accidents and reducing travel costs. The combination of new technologies in data acquisition with digital audio and video communication technologies — some of which are already implemented [redacted] — is a critical enabler to realise efficiency and effectiveness improvements.

Contemporary interfaces to database of important engineering knowledge and asset history— past decisions, design drawings, equipment specifications and technical drawings — is currently an enormous knowledge system improvement opportunity.

Investing to rationalise and aggregate information and store in repositories that are readily and remotely accessible is an increasingly pressing priority.

The adoption of SAP mobility and other transformative technologies are progressively realising benefits.

These factors are also drivers of the aforementioned need to increase operational funding to facilitate redress and speed benefits realisation.

5.5.3 Funding and Delivery Momentum

The business is currently facing significant financial pressures from the combination of sustained low inflows resulting in low lake levels, an extended Basslink outage and an expensive response to install temporary generation, buy-back contract positions and burn considerable amounts of gas to support the energy supply plan. These pressures and the resultant increase in corporation debt, a need to rebuild storages and repair the balance sheet, concurrent with a need to increase funding on hydropower assets and expend additional funds on 'new' previously unfunded programmes

combine to create a potentially challenging period ahead.

Cognisant of these challenges above and as part of exploring various funding scenarios used to determine the minimum level of investment required to prudently manage risk, maintain plant performance and leave a sustainable legacy for the future, analysis on differing levels of capital investment in the hydro assets was explored. This analysis demonstrated that even modest decreases in capital investment result in material impacts in turbine work (in particular) and result in a material increase in risk position.

[redacted] The Mersey-Forth and Derwent Schemes production lines are demonstrating increasing rates of deterioration that will result in business risk escalating quickly if refurbishments are not progressed (approximately) at the rate prescribed in the 10-Year Asset Management Plan.

In addition to the funding challenges above, emerging asset issues and other events are increasingly redirecting expenditure from planned activity to reactive interventions. Whilst atypical, [redacted] the estimated $3 - $6m of flood damage repair [redacted]. Reiterating again that the 10-Year Asset Management Plan describes the minimum level of activity required to sustain the performance and risk position of the hydro generation portfolio; anything that materially adversely impacts this lessens the integrity of the plan and increases risk accordingly.

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6. Operational Risk Management Programmes

Hydropower generation is provided by a portfolio of 61 machines in 30 stations that are distributed throughout Tasmania. The location of these stations and machines is illustrated in Figure 8. The asset management and operational challenges presented by the geographic dispersion are exacerbated by the extensive nature of the asset base - some 1600 key delivery chain assets.

The assets and operations are managed through a number of specific programmes of work. The objectives of these are to:

- discharge all duty of care and Regulatory/Legislative compliance obligations;
- identify and deliver customer/stakeholder requirements:
    - Asset type levels of service and generator performance levels.
- establish and maintain a prudent portfolio risk position;
- drive improvements in efficiency, effectiveness and economics:
    - Pursue productivity improvements; and
    - Develop and promulgate continuous improvement and innovation culture.
- develop and adopt best practice/contemporary processes, procedures and practices; and
- provide subject matter expertise and thought leadership.

The ongoing effective management of asset performance and prudent management of risk is dependent upon the Capital Investment Programme working in unison with a comprehensive set of operational risk management programmes.

In general, the operational programmes identify and manage asset risk and maintain productive capability while assets await life-sustaining capital investment to refurbish and replace.

Developing and resourcing these programmes, (the Turbine Integrity Programme in particular), is proving challenging within the current operational expenditure funding envelope. The annual level of expenditure allocated for the operational risk management programmes is circa $46m, split approximately 50% on internal labour and 50% on external service provision, (Entura, consultants and contractors), overhead expenses, consumables and materials. This Opex allocation also covers the provision of the corporate safety and sustainability functions.

Whilst this realises modest cost savings, it more importantly provides opportunity for further activity consolidation and rationalisation, which will yield material savings and delivery efficiency improvements.

6.1 Dam Safety Programme

The Dam Safety Programme provides the assurance that Hydro Tasmania's extensive dam portfolio is safe, fit for purpose and operable. The Dam Safety Regulator requires Hydro Tasmania to fulfil the obligations of dam ownership set out by Australian National Committee on Large Dams (ANCOLD) in their Dam Management and Practice Guidelines. The programme's core components are:

- Dam Surveillance: the primary front line dam safety defence. Hydro Tasmania's continuous improvement focus resulted in the development of the highly regarded "surveillance quality chain"; a systematic surveillance improvement and assurance framework;
- Dam Maintenance: the periodic routine maintenance activity that ensures the dam is operable and fit-for-purpose (drain cleaning, etc);
- Surveillance Reviews: a periodic comprehensive review of dam condition and performance to assure the dam is performing as intended/identify deficiencies;
- Dams under the Heightened Awareness: a programme where dams with known issues are closely monitored and managed until the issues are resolved;
- Investigation and resolution of priority issues on extreme and high consequence category dams (Scotts Peak, Edgar and Murchison Dams);
- Development and owner oversight of capital refurbishment work to dams;
- Communication with External Stakeholders: Dam Safety Regulator, Emergency Services, Councils and the ANCOLD; and
- Appraising the Board on the performance of the Dam Safety Programme which is also subject to external expert oversight.

6.2 Civil Asset Programme

The Civil Asset Programme is responsible for the water conveyance infrastructure, station access and egress (including roads and bridges) and station building infrastructure. Main focus areas include:

- Civil asset integrity assurance: canal surveillance and civil asset inspections;
- Maintaining operational integrity and service levels for roads and bridges;
- Identification and assessment of the risks associated with the extensive water conveyance assets;
- Cost effective reduction of the high and medium risk asset issues in the portfolio; and

- Development, owner oversight and acceptance of projects contained within the 10-Year Plan.

6.3 Mechanical and Electrical Asset Programmes

The Mechanical and Electrical Portfolio Programmes are responsible for maintaining the operational integrity and performance levels of the hydro generation assets. Core activities include:

- Understanding WES short and long-term portfolio requirements:
  - Ensure asset performance supports revenue maximisation; and
  - Identify opportunities for asset and portfolio enhancement.
- Assess asset condition, performance and risks through comprehensive programmes of asset events management, condition monitoring and functional testing, Water to Wire reviews, station risk assessments and operational integrity assessments;
- Ensuring strategies are in place to prudently manage duty of care and revenue risks;
- Planning and Initiating capex works and programmes in the 10-Year Plan; and
- Providing Governance over the rotating plant portfolios and ensuring the supporting programmes are effective and aligned to the corporation's objectives.

6.4 Delivery Assurance Programme

The Delivery Assurance Programme manages and reduces production delivery risks and assures the performance of the generation portfolio.

The purpose of the Delivery Risk component is the provision of outage planning and management and power system analysis to ensure efficient delivery of physical generation to the National Electricity Market. The aim is to maximise production opportunities at high priced periods and maximise available capacity to back energy hedge contracts.

The purpose of the Asset Assurance component of the programme is to ensure the generating assets are fit for purpose, safe to operate and compliant with Regulatory obligations.

Key functions in this programme include:

- Risk Assessment: Energy, capacity (production) and compliance risks;
- Power System Analysis: engineering analysis to identify delivery issues, assess risk and develop strategies and solutions to improve business performance;
- Commissioning/return to service: post maintenance and refurbishment assurance that the 'as installed' plant meets the design specifications and will deliver safe, compliant and reliable operation;
- Performance Testing and Analysis: engineering measurements, tests and analysis to assure the performance of the asset to deliver safe, compliant and reliable operation; and

- Asset Condition and Performance Assessment: engineering measurements, tests and analysis to assess the condition and performance of assets through data and trend analysis.

6.5 Statewide Maintenance Programme

The function of this programme is to safely manage, maintain and operate the hydropower assets and infrastructure. The primary purpose is to support WES, maximise revenue through flexible and responsive generation opportunities and provide the levels of service and risk management activity support to the other Operational Risk management programmes.

This is achieved through:

- maintaining an understanding and alignment with WES on short-term plant performance and availability requirements;
- understanding and aligning stakeholders requirements to WES performance requirements;
- maintaining operational, maintenance and planning resource capability:
    - Apprentice and trainee development;
    - GenTech/Operator training.
- implementation of annual Station Asset Management Plans:
    - Cost effective delivery of the cyclic routine maintenance programme;
    - Effective utilisation of SAP asset maintenance capability;
    - Management of Statewide works programmes:
        - Vegetation management;
        - Buildings management; and
        - Non-Generating Asset management

6.6 Bass Strait Islands

Key activities for the Bass Strait Islands operational management programme include:

- First and foremost maintaining reliable electricity supply to customers;
- Establishing a sustainable resourcing model through improved effectiveness in attraction and retention and a 'grow your own' approach to attracting existing island residents to undertake apprenticeships;
- Establishing a zero harm safety culture; reducing human error induced incidents through Safestart and ensure that safety and safe work practices are the number one focus, especially in hazardous conditions;
- Lead change in culture and asset management; the distribution areas in particular have been isolated and operate with a 'frontier' culture and a very reactive asset management model;

- Establishing common platforms and practices intra and inter island. The generation and distribution activities on each island and between each island have traditionally been distinctly separate. Thinking and acting as one team and one approach is the goal;
- Ensure prudent investment and risk management of the BSI asset base through effective maintenance practices via the adoption of SAP and implementation of a detailed 10-Year Asset Management Plan; and
- Maximise renewables penetration and zero diesel operation.

6.7 Operational Compliance Programme

The Operational Compliance Programme provides administration and governance of all processes and related systems required for asset maintenance and operations and works delivery activities. The purpose of this programme is to ensure (and be able to demonstrate) all staff and contractors are competent, accredited and apply all required operational controls and procedures in performing their roles.

6.8 Programme Management

The Business Operations team and Programme Management Office supports the delivery of all A&I operational and capital works programmes; providing administration and governance of business processes and related systems; and the management of relationships with Entura, Information Process Systems, and Corporate and People Services within Hydro Tasmania.

Key activities include:

- Provide support for the development, application and improvement of business systems and processes;
- Analysis of programme expenditure to identify efficiently opportunities and expenditure issues;
- Monitor and report on the financial and process hygiene of the various programmes;
- Maintain accurate Estimates at Completion and forecast expenditure profile for the various programmes;
- Develop and maintain a rolling three-year Opex Budget to aid in long-term planning and prioritisation;
- Drive the realisation of SAP business benefits for asset management processes and support the Hydro Tasmania initiative of Business Process Improvement; and
- Developing and maintaining a workforce plan for A&I to inform succession, recruitment and development strategies.

6.9 Sustainable Resource Management (SRM) Programme

The focus of the programme is to manage and reduce environmental regulatory intervention in operations by demonstrating responsible and pro-active environmental self-regulation.

The activities undertaken are to:

- ensure Hydro Tasmania retains access to the water resource for electricity generation;
- comply with environmental and heritage regulations and special water licence requirements;
- manage/influence policy and regulatory change to reduce/minimise obligations and impact;
- Minimise environmental impacts and where possible enhance environmental and social values; and
- Build strong and resilient external stakeholder and partner relationships.

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7. Capital Investment Programme

The Capital Investment Programme proposed in this edition of the 10-Year Asset Management Plan is dominated by turbine and alternator refurbishment programmes. These two programmes account for almost half of the annual capital budget over the plan period and determine the timing and the duration of the major intrusive maintenance outages.

Failure to achieve and maintain sufficient momentum in the Turbine Refurbishment and Runner Replacement Programmes has the potential to result in a progressive increase in revenue and duty of care risk for the business.

Typically the delivery programmes are highly fluid as they respond to a variety of issues; design and procurement issues, emergent work and latent defects, natural disasters, revenue opportunity, specialist skills availability and asset break down and failure. This requires regular reprioritisation of activity. As such, the timing and costs associated with activity detailed below is indicative only and subject to change.

7.1.1 Turbines and Alternators

Figure 13 below illustrates the currently planned outage schedules for the Turbine and Alternator Programmes over the coming plan period. The remaining Kaplan turbine refurbishments will be completed over the coming years,

Turbine runner replacement and alternator refurbishments for the aged Lower Derwent machines will commence in 2016 and be followed by the Mersey-Forth machines.

These priority investments are aimed at securing another extended period of safe and reliable operation for these machines. This again underlines one of the material risks to the integrity of the 10-Year Plan – maintaining sufficient momentum on planned activity whilst responding in a timely manner to the unforseen and unforeseeable reactive activity that emerges. This presents one of the most challenging, and perversely interesting and stimulating, dimensions of managing the hydropower asset portfolio.

Figure 13: Turbine and Alternator Capital Plan

Turbines		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Cluny	2017	Cluny									
Wayatinah 1	2017	Wayatinah 1									
Liapootah 1	2017	Liapootah 1									
Repulse+	2018		Repulse+								
Devils Gate	2018		Devils Gate								
Wayatinah 2	2018		Wayatinah 2								
Liapootah 2	2018		Liapootah 2								
Catagunya 1+	2019			Catagunya 1+							
Liapootah 3+	2019			Liapootah 3+							
Wayatinah 3	2019			Wayatinah 3							
Catagunya 2+	2020				Catagunya 2+						
Lemonthyme	2020				Lemonthyme						
Lake Echo+	2020				Lake Echo+						
Trevallyn 1	2020				Trevallyn 1						
Wilmot+	2021					Wilmot+					
Rowallan+	2021					Rowallan+					
Poatina 3+	2021					Poatina 3+					
Trevallyn 2	2021					Trevallyn 2					
Tungatinah 3	2022						Tungatinah 3				
Bastyan	2022						Bastyan				
Poatina 2	2022						Poatina 2				
Tarraleah 5+	2023							Tarraleah 5+			
Tarraleah 6+	2023							Tarraleah 6+			
Mackintosh	2023							Mackintosh			
Tarraleah 4+	2024								Tarraleah 4+		
Tarraleah 3+	2024								Tarraleah 3+		
Gordon 3	2024								Gordon 3		
Reece 1	2024								Reece 1		
Tarraleah 2+	2025									Tarraleah 2+	
Tarraleah 1+	2025									Tarraleah 1+	
John Butters	2025									John Butters	
Poatina 6	2025									Poatina 6	
Reece 2	2026										Reece 2
Tribute	2026										Tribute
Butlers Gorge	2026										Butlers Gorge

Note: A 'plus' symbol against a Turbine indicates the Alternator major work is aligned.

Alternators		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Repulse	2018		Repulse								
Catagunya 1	2019			Catagunya 1							
Liapootah 3	2019			Liapootah 3							
Catagunya 2	2020				Catagunya 2						
Lake Echo	2020				Lake Echo						
Tungatinah 2	2020				Tungatinah 2						
Rowallan	2021					Rowallan					
Poatina 3	2021					Poatina 3					
Wilmot	2021					Wilmot					
Poatina 4	2022						Poatina 4				
Tarraleah 5	2023							Tarraleah 5			
Tarraleah 6	2023							Tarraleah 6			
Poatina 1	2023							Poatina 1			
Tarraleah 4	2024								Tarraleah 4		
Tarraleah 3	2024								Tarraleah 3		
Poatina 5	2024								Poatina 5		
Tarraleah 2	2025									Tarraleah 2	
Tarraleah 1	2025									Tarraleah 1	
Cluny	2025									Cluny	
Meadowbank	2026										Meadowbank
Total Turbine & Alternator		**$43.7 m**	**$44.9 m**	**$45.6 m**	**$45.2 m**	**$46.2 m**	**$41.8 m**	**$42.2 m**	**$57.9 m**	**$44.6 m**	**$46.4 m**

7.1.2 Electrical Protection

The Electrical Protection asset portfolio is essential to the safe and compliant operation of the Hydro generation system.

these assets continue to be afforded a high priority under the 10-Year Asset Management Plan for timely replacement.

Table 5: Electrical Protection Capital Plan

Asset Type	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Electrical Protection	$2,920k	$1,209k	$1,562k	$1,751k	$1,934k	$2,715k	$1,409k	$2770k	$3051k	
RTU Upgrade	$119k									$590k
Transmission Protection	$909k	$172k	$789k	$921k	$725k	$1,321k	$711k	$857k	$288k	
Grand Total	**$3,948k**	**$1,381k**	**$2,351k**	**$2,672k**	**$2,660k**	**$4,036k**	**$2,120k**	**$3,627k**	**$3,339k**	**$590k**

7.1.3 Mechanical Protection and Unit Control

given the cost associated with wholesale replacement, for all but the most important machines, the strategy continues to be based on generally maintaining rather than replacing these assets. Where they are being replaced, there is an emphasis on maximising efficiency and savings with the system integration design, installation and commissioning costs that are major components of major machine upgrades.

Table 6: Mechanical Protection and Unit Control Capital Plan

Asset Type	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
MPU&C	$4,548k	$5,830k	$6,342k	$6,260k	$6,262k	$3,394k	$1,998k	$1,549k	$3,053k	$4,583k
Grand Total	**$4,548k**	**$5,830k**	**$6,342k**	**$6,260k**	**$6,262k**	**$3,394k**	**$1,998k**	**$1,549k**	**$3,053k**	**$4,583k**

7.1.4 Governor and Excitation

The development of an in-house governor solution and progressive insourcing of excitation system upgrades is dramatically reducing the delivery costs of replacement. It is hoped that ongoing progress with these solutions will enable more equipment to be replaced than is currently identified in the 10-Year Plan. Currently replacement is prioritised on the basis of alignment with major turbine upgrade

Table 7: Governor and Excitation Capital Plan

Asset Type	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Excitation System	$1,422k	$2,109k	$1,824k	$1,692k	$1,601k	$1,323k	$1,871k	$1721k	$1965k	
Governors	$2,077k	$2,231k	$2,032k	$1,248k	$855k	$960k	$1,097k	$1255k	$2263k	$656k
In Thousands	**$3,499k**	**$4,341k**	**$3,857k**	**$2,940k**	**$2,456k**	**$2,283k**	**$2,967k**	**$2,976k**	**$4,228k**	**$656k**

7.1.5 Dam Safety

The strategy for dam assets remains largely unchanged in this revision of the 10-Year Plan, although timing of the larger upgrades has been revised. The strategy centres on remediating two of the three remaining IBRM High risk dams (Edgar and Scotts Peak), continuing to better understand and develop an acceptable approach to Murchison dam and the ongoing improvement of the earth-filled embankment dams.

Table 8: Dam Safety Capital Plan

Asset Type	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Dam Instrumentation	$103k	$105k	$108k	$110k	$113k	$116k	$119k	$122k	$125k	$128k
Dam Safety	$2,934k	$7,571k	$7,726k	$6,788k	$16,094k	$17,106k	$3,655k	$3747k	$3840k	$3,936k
Grand Total	**$3,037k**	**$7,677k**	**$7,833k**	**$6,899k**	**$16,207k**	**$17,222k**	**$3,774k**	**$3,868k**	**$3,965k**	**$4,064k**

7.1.6 Civil Assets

Three quarters of the proposed civil asset investment is associated with penstocks and pipelines. A significant component of this is allocated to the renewal of external protective coatings. These work packages provide the much needed opportunity to flex in response to programme changes and otherwise assist in smoothing the capital profile over a number of financial years.

The concrete and structural infrastructure becomes a priority at the back end of this plan period and will dominate expenditure over the subsequent 10-year period.

Table 9: Capital Plan for Civil Assets FYE2016 to FYE2025

Asset Type	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Bridges	$1,244k	$735k	$538k	$792k	$696k	$535k	$609k	$624k	$640k	$656k
Canals and Flumes	$1,999k	$586k	$1,397k	$670k	$57k	$2,518k	$2,007k	$61k	$62k	$1,909k
Penstock	$3,500k	$4,323k	$4,234k	$2,602k	$5,753k	$10,600k	$33,751k	$24066k	$22109k	$16,089k
Pipeline	$1,046k	$525k		$113k	$3,596k	$4,277k	$4,995k		$5375k	$2,560k
Remote Access	$520k	$525k	$491k	$283k	$119k	$122k	$125k	$128k	$131k	$134k
Roads Safety Upgrade	$513k	$525k	$552k	$566k	$580k	$594k	$609k	$624k	$640k	$656k
Structures	$144k	$51k				$162k	$166k	$170k	$174k	$179k
Tunnels	$1,051k	$1,051k	$3,772k	$5,515k		$1,218k				$640k
Station Post Tension Anchors	$158k	$162k	$166k	$735k	$580k	$594k				
Intake, Forebays and Tailraces	$2,009k	$1,947k	$304k	$1,072k	$302k	$119k	$317k	$125k	$128k	
Engineered Slopes	$308k	$525k	$269k	$276k	$283k	$290k	$297k	$305k	$312k	$320k
Grand Total	**$12,490k**	**$10,956k**	**$11,724k**	**$12,623k**	**$11,966k**	**$21,030k**	**$42,877k**	**$26,103k**	**$29,572k**	**$23,143k**

7.1.7 Bass Strait Islands

The Bass Strait Islands forward investment will address the pressing risks of compliance, duty of care and functional failure of the generation and distribution assets.

Table 10: Bass Strait Islands Capital Plan

Asset Type	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
FI Distribution	$249k	$244k	$251k	$257k	$263k	$270k	$277k	$283k	$448k	$459k
FI Facilities	$74k			$68k	$12k				$64k	$66k
FI Generator	$1,117k	$503k	$334k	$21k	$22k	$13k	$1,125k	$1028k	$256k	$262k
KI Distribution	$261k	$224k	$230k	$281k	$288k	$295k	$302k	$310k	$448k	$459k
KI Facilities	$32k		$88k	$68k	$12k		$12k	$75k	$64k	$66k
KI Generator	$470k	$1,084k	$221k	$359k	$590k	$20k	$182k	$316k	$256k	$262k
Grand Total	**$2,201k**	**$2,056k**	**$1,124k**	**$1,053k**	**$1,187k**	**$598k**	**$1,897k**	**$2,012k**	**$1,536k**	**$1,575k**

7.1.8 Planned Investment by Asset and Station

Tables 11 and Table 12 below summarise the capital investments required by key delivery chain asset type and by power station. Where possible, all investment and major maintenance activity is aligned to the timing of the turbine and alternator refurbishments.

Table 11: 10-Year Capital Plan by KDCA

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Dam Safety	$2,934k	$7,571k	$7,726k	$6,788k	$16,094k	$17,106k	$3,655k	$3,747k	$3,840k	$3,936k
Dam Instrumentation	$103k	$105k	$108k	$110k	$113k	$116k	$119k	$122k	$125k	$128k
Canals & Flumes	$1,999k	$586k	$1,397k	$670k	$57k	$2,518k	$2,007k	$61k	$62k	$1,909k
Pipeline	$1,046k	$525k		$113k	$3,596k	$4,277k	$4,995k		$5,375k	$2,560k
Penstock	$3,500k	$4,323k	$4,234k	$2,602k	$5,753k	$10,600k	$33,751k	$24,066k	$22,109k	$16,089k
Tunnels	$1,051k	$1,051k	$3,772k	$5,515k		$1,218k				$640k
PPA Gates & Valves	$5,154k	$5,086k	$4,950k	$10,635k	$10,011k	$3,269k	$640k	$1,240k	$1,239k	$3,710k
Gates & Valves	$877k	$1,899k	$842k	$3,701k	$1,724k	$1,024k	$999k			$2,624k
Turbine	$36,994k	$35,689k	$38,235k	$37,755k	$41,499k	$33,419k	$31,627k	$40,596k	$31,208k	$32,354k
Alternator	$5,310k	$8,516k	$7,011k	$7,438k	$4,656k	$8,356k	$10,616k	$17,337k	$13,350k	$14,023k
Cooling Water System	$105k					$594k	$609k	$624k	$640k	$656k
Mech Prot & Control	$4,548k	$5,830k	$6,342k	$6,260k	$6,262k	$3,394k	$1,998k	$1,549k	$3,053k	$4,583k
Electrical Protection	$3,380k	$2,380k	$2,281k	$2,672k	$2,660k	$4,036k	$2,120k	$3,627k	$3,339k	$590k
Governor & Excitation	$3,499k	$4,341k	$3,857k	$2,940k	$2,456k	$2,283k	$2,967k	$2,976k	$4,228k	$656k
Circuit Breaker	$1,139k	$367k		$1,070k	$61k	$1,168k	$366k	$375k	$384k	$394k
Transformer	$3,034k	$1,738k	$3,783k	$2,982k	$2,750k	$5,451k	$6,124k	$4,043k	$7,945k	$9,123k
EHV Instrument Transformer	$126k	$474k					$150k			
AC&DC Systems	$2,061k	$2,342k	$1,848k	$2,293k	$1,158k	$1,286k	$1,336k	$1,126k	$512k	$525k
Fire Prot Haz & Risk Mit	$525k	$700k	$706k	$566k	$928k	$951k	$624k	$128k	$320k	$328k
Contingency Spares	$215k	$210k								
Roads	$513k	$525k	$552k	$566k	$580k	$594k	$609k	$624k	$640k	$656k
Bridges & Remote Access	$1,764k	$1,261k	$1,030k	$1,075k	$815k	$657k	$734k	$752k	$771k	$791k
Station Post Tension Anchors	$158k	$162k	$166k	$735k	$580k	$594k				
Minor Assets	$205k	$210k	$215k	$170k	$174k	$178k	$183k	$187k	$192k	$197k
Minor Projects	$410k	$525k	$386k	$396k	$406k	$416k	$426k	$437k	$448k	$459k
Bass Strait Islands	$1,125k	$2,056k	$1,124k	$1,053k	$1,187k	$598k	$1,897k	$2,012k	$1,536k	$1,575k
Headworks Control and Protection	$669k	$263k	$552k	$1,131k	$1,160k	$1,783k	$609k	$624k	$640k	$656k
Structures	$2,153k	$1,995k	$304k	$1,072k	$302k	$281k	$483k	$295k	$302k	$179k
Pumps									$3,936k	$8,742k
Land and Facilities	$761k	$610k	$1,180k	$1,485k	$1,150k	$730k	$987k	$540k	$400k	$400k
Environment and Water	$757k	$552k	$457k	$389k	$466k	$353k	$171k	$239k	$308k	$298k
Engineered Slopes	$308k	$525k	$269k	$276k	$283k	$290k	$297k	$305k	$312k	$320k
Non Generating Assets	$128k	$47k	$538k	$585k	$588k	$603k	$618k	$24k	$25k	$26k
Asset Performance Instrumentation	$256k	$263k	$269k	$276k	$283k	$290k				
Asbestos Man't	$205k	$762k	$1,139k	$416k	$453k	$23k				
	$87,010k	**$93,492k**	**$95,272k**	**$103,734k**	**$108,203k**	**$108,456k**	**$111,719k**	**$107,656k**	**$107,241k**	**$109,125k**
Adjustment to align to Corporate Plan				-$6,200k						
Corporate Plan (2016)	**$87m**	**$93.5m**	**$95.3m**	**$97.5m**						

Note: All investment quoted in nominal dollar basis. Estimated in FYE2016 dollars and escalated by 2.5% each year.

Table 12: 10-Year Capital Plan by Station

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Gordon	$2,985k	$4,599k	$16,555k	$6,326k	$23,251k	$16,497k	$5,454k	$12,222k	$2,319k	
Poatina	$4,372k	$9,086k	$1,692k	$6,168k	$14,753k	$12,278k	$2,709k	$5,300k	$7,608k	$640k
Reece	$1,199k	$220k	$1,145k			$1,001k	$2,827k	$12,514k	$2,992k	$15,041k
John Butters	$308k	$126k		$589k			$357k	$2,239k	$11,480k	$1,968k
Tarraleah	$4,256k	$1,850k	$3,330k	$4,237k	$6,341k	$26,126k	$50,318k	$38,709k	$22,435k	$6,970k
Tungatinah	$2,539k	$1,825k	$1,126k	$8,853k	$3,716k	$10,986k	$8,796k	$15,221k	$17,837k	$15,137k
Cethana	$134k				$1,817k	$3,679k				
Lemonthyme			$4,300k	$19,558k	$1,189k	$609k				$3,362k
Mackintosh	$205k	$2,654k				$2,758k	$12,989k	$1,873k		
Devils Gate	$3,546k	$9,947k	$5,844k					$576k		$4,608k
Trevallyn	$2,201k	$1,833k	$2,035k	$12,223k	$12,359k	$850k	$247k	$253k	$259k	$1,280k
Liapootah	$14,204k	$12,408k	$11,650k	$1,209k			$2,377k	$2,437k		
Bastyan	$1,538k	$599k			$2,928k	$12,657k	$1,828k	$366k		
Catagunya	$2,247k	$5,599k	$16,849k	$15,001k	$1,788k					
Tribute	$524k		$39k	$639k		$1,218k			$3,347k	$11,189k
Wayatinah	$15,654k	$10,547k	$9,183k	$364k		$357k				
Fisher	$2,125k	$428k	$166k		$61k	$1,141k	$4,309k		$7,785k	
Meadowbank				$1,160k	$2,377k	$2,437k	$1,783k	$2,437k	$3,280k	$7,875k
Repulse	$4,726k	$10,184k	$5,891k	$340k					$3,747k	
Paloona	$230k	$162k		$256k			$2,498k			
Wilmot	$1,211k	$3,631k	$711k	$4,255k	$15,120k	$1,248k	$1,249k			
Cluny	$11,026k	$3,581k	$198k	$170k	$475k	$2,319k		$1,280k	$3,936k	
Butlers Gorge	$308k		$896k	$1,234k	$396k			$375k	$1,936k	$11,793k
Lake Echo	$541k	$1,820k	$3,732k	$8,732k	$1,218k	$99k	$999k			$1,230k
Rowallan	$1,620k	$1,390k	$1,403k	$3,157k	$10,492k	$594k				
Derwent Pumps							$2,248k			
Lake Margaret	$636k	$2,182k	$784k	$931k	$972k	$230k			$1,312k	
Arthurs Lake	$105k			$221k		$297k	$1,998k			$4,842k
Newton Pumps	$377k					$305k		$122k		$2,017k
Bass Strait Islands	$1,125k	$2,056k	$1,124k	$1,053k	$1,187k	$598k	$1,897k	$2,012k	$1,536k	$1,575k
Parsons Falls Pumps		$112k	$144k						$1,968k	
Serpentine Pumps						$208k			$1,575k	$1,614k
Shannon Pumps						$178k			$1,968k	$2,017k
Tods Corner		$103k	$287k	$55k		$144k				
Yeates Creek Pump										$2,017k
Yates Pumps						$208k				
Weston Pumps	$179k									
Statewide	$6,890k	$6,551k	$6,189k	$7,002k	$7,764k	$9,434k	$6,837k	$9,723k	$9,922k	$13,949k
Grand Total	**$87,010k**	**$93,492k**	**$95,272k**	**$103,734k**	**$108,203k**	**$108,456k**	**$111,719k**	**$107,656k**	**$107,241k**	**$109,125k**
Adjustment to align to Corporate Plan				-$6,200k						
Corporate Plan (2016)	**$87m**	**$93.5m**	**$95.3m**	**$97.5m**						

Note: All investment quoted in nominal dollar basis. Estimated in FYE2016 dollars and escalated by 2.5% each year.

7.2 Capital Investment Governance

The Investment Management Team (IMT) apportions divisional capital allocations and then, when above a threshold, approves individual capital projects or procurement packages (and unbudgeted operational expenditure). The IMT is chaired by the CFO and, in addition to funding approval, provides governance over expenditure. The 10-Year Asset Management Plan capital allocations are reviewed and updated annually to provide the IMT with the macro details of planned work programmes. Prior to any significant project commercial commitment, funding approval via 'gate papers' is required from the IMT, and/or the Board in accordance with prescribed delegation limits.

Hydro Tasmania typically applies a formal tender and procurement process for any material equipment or services supply contracts to ensure competitive tension and the best value to the business. Tender assessment practises are mature and based on holistic tender assessment models that ensure best overall value and not solely least expensive options are considered. All tender and major contracting activity is co-ordinated by the Contracts and Procurement team operating under the auspices of the CFO.

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8. Staff

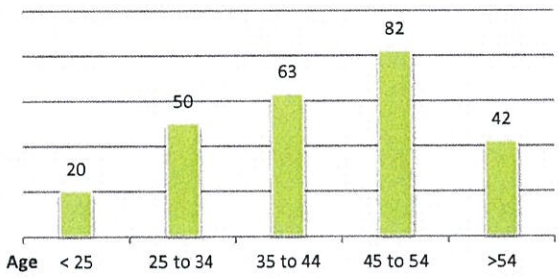
Often businesses refer to staff as their greatest asset, but research suggests this is seldom reflected in how people feel about their jobs. There are two primary people-related objectives detailed in the 10-Year Asset Management Plan; create an environment where staff experience an invigorating sense of purpose by being able to grow themselves and their careers through meaningful and purposeful contribution to this iconic Tasmanian enterprise and through this, sustain sufficient workforce capability to deliver the 10-Year Asset Management Plan.

Knowledge management, mentoring, training and development and effective management are all key areas of focus in the Workforce Plan, the purpose of which is primarily aimed at ensuring the scientific, engineering and technician skills availability required for the long-term sustainability of Hydro Tasmania's asset management capability.

Over the past several years significant improvements have been realised:

- The number of staff has been significantly reduced (circa 50 people on a like for like comparison):
    - Simultaneously the use of external contactors has also been reduced.
- Material productivity improvements have been realised;
- Concerted focus on apprentices, trainees and graduates has reshaped the age profile of staff;
- Reliance on an external asset expertise and works delivery model has been reduced:
    - This has significantly improved quality outcomes and reduced risk and delivery cost.
- Significant improvement in leadership capability, management skills and business focus:
    - This has assisted in transforming culture to a one-business culture that is far more commercial, accountable and connected.

Figure 14: Age Demographic of A&I Staff



There remain material demographic issues to surmount, most noticeably the stark gender imbalance in trades and engineering based professions. Whilst there are no ready-made solutions, meaningful progress has been made with the number of female engineers, apprentices and leaders increased over recent years.

A&I has a functioning workforce plan and has implemented a number of development programmes to manage specific areas of need and opportunity as effectively as possible within the business constraints imposed. In general, to date this has successful, resulting in the right number of people with the requisite skills, behaviours, knowledge and experience being available to undertake the work programmes required.

The core elements of the A&I Workforce Plan are:

- Strategic Plan to define and ensure future requirements are understood and being progressed;
- Succession Planning to manage retirement/attrition of core skills and expertise;
- Knowledge transfer and Mentoring Plan;
- Recruitment Planning;
- Leadership development;
- Development Training Plan (Career Development Pathways); and
- Compliance Training Plan.

The workforce plan is underpinned by the following activities:

- Apprentice Programme;
- Graduate Programme;
- Asset Management Skills Project:
- Mentoring Programme; and
- Engineer and Technician Development Programme.

The drivers of workforce planning over the coming 12 months are:

- The increased capital investment programme and the shift in its emphasis to major intrusive maintenance. This will require further augmentation of staff numbers and increased major works delivery skills:
    - The cost efficiencies and improved quality outcomes derived from the insourcing of this activity are compelling. Over the coming 12-18 months full realisation of the benefits and effective management of the forward works programme will necessitate an additional 10-12 personnel focused on capital works delivery.
- The proposed changes by further insourcing core requirements from Entura will also add a further eight to ten resources:
    - This change will result in both material reductions in expenditure and provide an important opportunity for further rationalisation of activity and decrease reliance on external skills and service providers.

9. Key Success Factors

Key Success Factors	Objectives and Focus for FYE2017
1. Support Hydro Tasmania strategy and objectives: a. Retain portfolio capability; b. Support WES maximise revenue; c. Maintain operational flexibility.	• Maintain progress on priority 'Strong and Reliable' production line target; • Implement agreed priority projects to improve hydro generation portfolio flexibility, capacity and performance; • Maintain operational flexibility and social license inherent in water rights.
2. Maximise enterprise value: a. Maximise production opportunities; b. Reduce asset related risk; c. Minimise costs.	• Reduce WES value loss from outages and plant performance issues; • Reduce number of high and medium asset risk issues; • Develop more innovative delivery practices to increase efficiency, effectiveness and improve economics. • Continue insourcing strategy • Further embed lean practices and operational excellence framework.
3. Enhance staff capability: a. Create an environment where staff experience an invigorating sense of purpose; b. Establish a culture where staff are Accountable, Connected and Commercial; c. Establish a zero harm safety culture.	• Ensure 'line of sight' from personal and team activity to business outcomes; • Broad involvement in preparation and delivery of A&I improvement activities; • Actively support gender diversity and broad inclusion through improved awareness and sensitivity and bespoke interventions; • Delivery of the annual training and development plan;. • Maximise value from PDR process and ensure regular and authentic communications. • Further embed SafeStart to reduce human error induced incidents.
4. Ensure a sustainable legacy for the future: a. Establish effective knowledge management practices to ensure ongoing availability of critical skills; b. Utilise the transformative capability of technology investments to innovate and drive effectiveness and efficiency; c. Establish a culture of responsible custodianship of the environment.	• Continuous improvement of asset management processes to drive consistency; • Advance utilisation of knowledge portals to improve information availability and management; • Extend utilisation of SAP mobility, Andritz AM functionality and National Instruments capability to innovate and increase asset management productivity; • Improve environmental and cultural heritage awareness and sensitivity.

The activities and measures that support the delivery and measurement of the Key Success Factors are reported and communicated via the A&I Balanced Scorecard.

10. Conclusion

The 10-Year Asset Management Plan details the capital investment and operational risk management programmes required to deliver the hydropower and BSI asset strategy. The focus and discipline provided by the implementation of successive 10-year Plans has facilitated tremendous improvement in asset management practice and outcomes delivered over the past several years.

The major risks associated with the hydropower portfolio are its [redacted] age, deteriorated condition and [redacted] market operating requirements. These factors combined result in a challenging forward programme of major capital renewal [redacted]

The 2016 revision of the 10-Year Plan presents the need for an increased amount of capital investment over the plan period. The increase is required to ensure the turbine and alternator refurbishments continue at a rate sufficient to maintain a prudent portfolio risk position and support the revenue objectives of the business. This edition of the 10-Year Plan is also signalling a requirement for modest increases in operational expenditure, [redacted]

Whilst the description of [redacted] risk and [redacted] deteriorated assets of advanced age appears somewhat sombre, it is important to balance this with the considerable progress and improvement that has been made to date and the good work that continues to occur. Whilst currently increasing, the overall risk position in the portfolio has been dramatically repositioned from where it was several years ago. Investment in asset type programmes, people skills and staff capability has yielded significant returns for the business and has positioned it well for managing the challenges that will present in future years.

The business has established an asset management system that is efficient and effective and an ongoing commitment to innovation, continuous improvement and productivity gains will ensure investment and expenditure in the asset base continues to be value accretive.

The A&I Leadership Team remain positive and enthusiastic about challenges in ensuring the long-term sustainability of the hydropower portfolio. Ongoing determined implementation of the 10-Year Asset Management Plan will ensure the business retains the benefit of renewable energy generation as the country and indeed the planet, increasingly embraces the reality of needing to rapidly constrain carbon dioxide emissions.

A&I will continue to report transparently to the Board on the progress and ensure clear communication of changes in risk position.

A&I recommends the 10-Year Asset Management Plan to the Board for endorsement.